SUPPLEMENT.

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FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

THE MINERAL INDUSTRY OF SCOTLAND.

THE KINING PARK MINERAL OIL ENGINEERING WORKS.

The Scotch mineral oil trade has now assumed such ample proportions that large engineering works are carried on by Messrs. George Bennie and Co. at Kining Park, Glasgow, with the sole purpose of manufacturing the apparatus used in that industry. The Kining Park Foundry was originally erected, many years ago, for the manufacture of heavy castings for the marine engines and vessels built on the Clyde by Messrs. Robert Napier and Co., and other leading shipbuilding firms. When, however, the mineral oil trade was proved beyond doubt to be a progressive and flourishing industry Messrs. Bennie and Co. determined to give themselves up entirely to the manufacture of oil-making machinery, and one of their first orders was for a number of retorts for the Bathgate Works, of Mr. James Young, the inventor of paraffin oil. Since then they have supplied apparatus for nearly every establishment of a similar character, whether at home or abroad; and these works may be said at the present time to possess a peculiar interest, from the fact that they have just been entrusted with the supply and erection of a large plant for the first mineral oil works that have ever been built in Russia. We may here explain, in reference to these contemplated new works, that some specimens of shale found in the neighbourhood of Moscow were some time ago forwarded to Mr. Bennie for the purpose of analysis. Mr. Bennie, on a careful analysis, found that the shale possessed the necessary properties for the distillation ot mineral oils, and reported accordingly. This led to the formation of a company at Riazen, some miles from Moscow, under the name or style of the Mouraevna Coal Company, their objects being to work the shale and manufacture mineral oils on the spot. A few weeks ago Mr. Bennie went to Moscow, surveyed the ground, and drew up specifications for the proposed new works; and (the first shipload of machinery having left Mr. Bennie's works last week) their erection will be proceeded with immediately. In the meantime 27 retorts will be erected, with a refinery, five stills, and large receiving and worm tanks. All the apparatus is to be of the largest size, the receiving tank being 28 ft. long, and on the most economical and improved principles. Provision is to be made for doubling the size of the works at an early date, should the experiment prove successful. The works are expected to be in full operation before next spring, and they are to be adapted for the carrying out of every process connected with the manufacture, from the distillation of the shale to the refining of the oil, in its various qualities and forms. We may add the obvious reflection that if Russia goes into the mineral oil trade on anything like an extensive scale, it will seriously diminish the export trade of this country.

The Kining Park Foundry covers fully two acres of ground. The two principal shops are built at a right angle to each other, one of them being 150 ft. in length by 50 ft. in breadth, while the other measures 100 ft. by 45 ft. Opening into these large shops there are two smaller erections, in which the lighter work is executed, while there is another building, two stories in height, on the opposite side of the yard, the upper flat of which is used as a drawing loft, while the ground floor is adapted for the purposes of a store. Connected with the large shops there are nine drying stoves, varying from 24 to 30 ft. in length, and from 8 to 20 ft. in width, in which the necessary drying operations are carried on. Throughout the workshops there are lines of rails for running out or in the large moulds used in the manufacture of castings. and at intervals, scattered up and down the premises, there are a number of very heavy foundry cranes. These cranes are all made of solid oak, bound with iron, and are capable of lifting from 25 to 30 tons each. Attached to the foundry there are four cupola furnaces, of different sizes, to which blast is supplied by a fan, 7 ft. diameter, making 1500 revolutions per minute, and worked by an engine of 15-horse power. Besides the cupola furnaces, there is a large air furnace, capable of containing a charge of 50 tons. This furnace is connected with a chimney 100 ft. in height, lined internally with fire-bricks, and girt externally with iron hoops. This furnace, however, is very seldom used, the cupolas being equal to nearly every requirement.

The moulding of retorts, which is one of the chief branches carried on at the Kining Park Works, is done in boxes made for the purpose, of large size, and consisting of two halves, longitudinally. Both vertical and horizontal retorts are manufactured on an extensive scale. The horizontal, however, are now the staple kind. They are of oval shape, and of uniform diameter throughout, the length being 11½ ft., and the transverse and vertical diameters being respectively 2 and 3 ft. The weight of the iron varies from 50 to 60 cwt., the case being about 30 cwt., the box about 6 tons, and the whole mass, including the sand, weighing upwards of 12 tons. There are always a large number of these retorts lying in the foundry yard, either finished or in the hands of the dressers. Since they went into their present line of business Messrs. Bennie and Co. have furnished upwards of 3000 retorts of all kinds. The quality of iron used in this manufacture is a mixture of the best Scotch, English, and Welsh brands. These retorts are capable of bearing a great heat without cracking, and the same remark applies to the stills. With reference to the latter, we may remark that, as made at this foundry, they are all of the same shape, being nearly hemispherical, with a dome-shaped cover, and having a capacity of 1500 gallons.

The mode of casting the stills is worth some attention. A hemispherical sort of excavation, some 10 ft. deep by the same width, is made on the floor, and lined with a layer of bricks, faced with a layer of loam. This is worked with the utmost exactitude by means of a wooden templet from a central axis or pivot. The exterior of the still having thus been provided for, its thickness is produced by carefully lining the external mould with sand to the extent of about 1¼ in. The core having been formed with bricks and loam laid within the layer of sand, it is afterwards lifted out of the place, and dried in the loam stove. The layer of sand is next removed, and the external mould is dried *in situ* by suspending a fire in it for some time. When both the core and the external mould are properly dried the former is fitted into the latter, and a clear space is thus left between them. Into this space the liquid metal is poured to form the still. In each still upwards of 6 tons of liquid metal are used.

Some years ago Mr. Bennie invented, but neglected to patent, an apparatus for generating superheated steam. It is already in operation at a great many oil works throughout this country, and we understand that all who have adopted it speak warmly in its favour. The steam generated in these superheaters has so intense a heat that when experimented on it has been found equal to the ignition of a piece of paper. The superheated steam is used in the retorts directly for the liberation of the oily vapours, or it is applied to the refining stills by means of worms.

We may add that Messrs. George Binnie and Co., as in the case of the Russian establishments already alluded to, design works of any extent, and build and equip them completely, in addition to fitting up the necessary machinery. The firm thus employ a large staff of workmen throughout the country, in addition to those whose labours are confined to the foundry at Kining Park. Messrs. Binnie and Co. are largely employed in the manufacture of other forms of cast-iron apparatus required by oil refineries, such as furnace doors, soap frames, steam jacketed pans, separators, iodine stills, condensers, and hydraulic mains, and their own superheaters.

BIRMINGHAM, AND THE BLACK COUNTRY—No. XVI.

THE WORKS OF MESSRS. NOAH HINGLEY AND SON, DUDLEY.

What will not industry, honesty, and perseverance accomplish? The founder of the firm bearing the above name has given a very fine example of what may result from the practice of these qualities. Noah Hingley is a gentlemen held in high esteem by those with whom business brings him in contact. He has just concluded his second year of office as Mayor of the borough of Dudley; and, although a very old man, he has fulfilled his duties in a manner that would be creditable to anyone. In early life Hingley was a working chainmaker, or as some say a nailer; let that be how it may, we know he was nothing but a poor working man; and, although having had scarcely any education whatever, he was soon enabled by continued industry, and when but a very young man, to start a chain shop of his own, and employ labour. From that time to this he has gradually risen, slowly but surely, step by step, till he is now joint proprietor with his son of large collieries, ironworks, and chain and anchor shops. He first manufactured small chains, then added to that the branch of heavy ship-cable making, and then started works for the production of finished iron. In 1838 Mr. Hingley attempted to make anchors at his works in Staffordshire, but it was not till nearly the year 1848 that he succeeded in establishing that trade. Anchors up to this time had always been made near to the chief seaports, but it was soon found to be a preferable and more economical plan to make the finished article where the iron was produced, rather than convey the raw material to a distance, there to be manipulated. Messrs. Hingley and Son have the Gawn and Reddal Hill Collieries, the Netherton Furnaces, and the Netherton Iron, Chain-Cable, and Anchor Works, besides a principal share in a large ironworks at Harts Hill. Altogether there are about 2000 workpeople employed by this firm, and from the Netherton Works alone can be produced 300 tons of finished iron, 100 tons of chains and cables, besides anchors, &c. The Netherton Blast-Furnaces, which we shall first notice, have only been in the hands of the firm for two or three years. They formerly worked the Dudley Wood Furnaces, but these were very old-fashioned, and are now taken down. Since taking possession of the former plant they have made many improvements, and in time will make it a creditable place.

There are two brick furnaces, one square and the other round. The former is of the type adopted many years ago, and is very lumbering, requiring an unnecessary number of bricks, filling a large amount of space, and yet being easily affected by the expansion caused by the heat, besides being very inconvenient to those who attend to the tuyeres. The whole of the furnaces built in Staffordshire for several years past have either been round, of red and white brickwork, bound with wrought-iron bands, similar to the second one at this plant, or cased with iron, supported upon cast-iron columns, and are a great improvement upon the old ones. The materials are drawn to the top of the furnaces by a small engine, up an incline placed upon timber, and brick pillars. There are two small old engines used for producing the blast, each having the steam-cylinder at one end of a beam, and a blowing tub at the other. This class of engine is still adopted in many instances in preference to those of more modern construction, which are fitted with fly-wheels. It is maintained that with the old description of "slamming" engine more blast is raised, and that the supply is more regular. There is a great amount of truth in this, but there is for all that a strong objection, and that is the stroke of the engine being entirely dependent upon the valves and the steam. If at any time the valves should fail to act perfectly the stroke would vary, and the engine would, probably, "come in," causing great destruction; to prevent this occurrence catch pins are placed at each end of the beams of these engines, and provision made to receive them upon the engine increasing its usual stroke, but should it "come in" rather fast they would be of no avail. In the most approved engines where fly-wheels are used the stroke of the engine is sure to be regular, and can always be depended upon, whilst the accumulated power in the fly-wheel carries the engine over the centres, and by this distribution of force from the fly-wheel, which is literally a reservoir, the working is regulated, and the engine is assisted at each end of the stroke when the steam has, comparatively speaking, little power. There is a disadvantage with a fly-wheel, and that is the combining of a direct with a circular motion which must necessarily give, to a slight degree, irregular working. We may see this, by making a square in the circle, which the crank describes, for when the piston is going up or down, and the crank is traversing the vertical sides of the square, both are travelling at near a uniform speed, but when the crank is passing along the horizontal sides of the square, which are, of course, equal to the vertical ones, the piston is almost at rest, and moves but a very short distance. Now, it is a question if this motion is suitable for either water or blast, and whether it is not better to allow these elements to regulate the speed of an engine by their natural flow. There is hardly any doubt that an engine independent of a fly-wheel is the correct thing for either pumping or blowing if the length of stroke can be depended upon. The argument we have deduced is more applicable in the case of water, which is the heavier and more powerful element, and acts with a much greater resistance, but the action is similar with air, although to a less degree. Taking all this into consideration, we would in the case of blast-engines go with the large majority, and have fly-wheels, as we think the advantages gained by their use preponderate over those resulting from the "slamming" action. The two blast-engines at the Netherton Furnaces are very old, and will be shortly replaced by one of far larger proportions, for which the house is already built. The steam is generated in several plain egg-ended cylindrical boilers, and these are heated by the gas taken from the top of the round furnace. The plan in operation for utilising the waste gases is either Addenbrooke's, or a modification of it. A wrought-iron flue, cased with fire-brick, surrounds the furnace top, with openings out of it into the interior of the furnace, and through these the gas is drawn off by a large square brick stack into the encircling flue, and from thence down a wrought-iron main, which passes along the front of the boilers, and has connections from it to the grates. The blast is heated in oval-shaped stoves, fitted with round twin pipes, and into these a portion of the gas is conveyed. The argillaceous ironstones of the district are principally used in the furnaces, together with a mixture of cinder, Northampton ore, and hematite.

The Netherton Ironworks are at no great distance from the foregoing furnaces, and here the chief offices are situated. In No. 1 forge a condensing beam-engine, with 44-in. cylinder and 6-ft. stroke, drives a forge train and two mills. There are 15 puddling-furnaces, and the balls from these are shingled under a 3-ton steam-hammer. No. 2 forge has been constructed at a more recent date than the last-mentioned, and is better laid out. There are 14 puddling-furnaces, arranged in two lines at right angles with each other, forming the two sides of a square; the machinery, consisting of a high-pressure horizontal engine, with 25-in. diameter cylinder and 3-ft. stroke, driving a large helve, forge train, bull-dog crushing-rolls, and shears, is placed at the opposite angle to that at which the two lines of furnaces meet, and consequently the said furnace are conveniently placed for getting their charges to the hammer. They are all in close proximity to the machinery, and the spongy masses of iron can be conveyed thither without the puddlers coming into collision, or crossing each others standing places. The engine in No. 2 forge also drives two small merchant mills, and to these there are the usual heating-furnaces. A high-pressure horizontal engine, having a cylinder 20½ in. diameter, and working a stroke of 4 ft., gives motion to a small merchant train. The steam for the whole of the foregoing engines is raised mostly in furnace-boilers, but there are a few firing-boilers to act as auxilieries to these. A new wing is being erected, which is called the new side, and will contain a forge and a large mill. A condensing beam-engine, with 44-in. cylinder and 7-ft. stroke, is placed near the centre of this new works, and will drive the whole of the machinery, consisting of a large helve, a forge train, a 14-in. mill, and two pairs of lever-shears. A circular-saw will be driven by a band from a small vertical engine. This plant is being put down in a most substantial manner; everything is strong and well fitted, and, what is very unusual, the cam ring shaft is of wrought-iron, and is a very clean, good forging; it has been made by Messrs. Hill and Smith, under their 5½-ton Condie's steam-hammer. The puddling-furnaces are arranged round the machinery, and most of them will work into vertical boilers, which will supply steam for the engine. It is expected that this portion of the works will be in full operation about Christmas, and will then considerably increase the make of iron for the firm.

We will now draw attention to the chain, cable, and anchor shops, but before describing them will very briefly sketch the history of these several trades. The manufacture of chains and cables is carried on principally in the neighbourhood of Dudley, Tipton, and Stourbridge. We hear that a certain E. Billingham and his two sons, somewhere about the year 1824, made chains for the London market in the vicinity of Dudley. Soon after their start, others took the matter up, and about the year 1834 the manufacture began to develope rapidly. In 1866 it was stated that about 60,000 tons of chains and cables was the average annual production; but at the present time this weight will be largely increased. Some of the old hands in the trade tell us that they never knew the trade better than it is now, considering the time of year, so that it is evident this branch of manufacture is sharing in the good fortune that has fallen to the iron trade. The demand for Staffordshire iron is greater, we believe, than has ever been known, and it is mostly for export trade. Firms who a year back were almost begging for orders have now their books closed, and cannot undertake fresh work, even to oblige their oldest customers; this state of things is not just confined to one portion of the district, but is quite general. The manufacture of anchors, as we before stated, was first introduced into the South Staffordshire district by the head of this firm, Mr. Noah Hingley. He first started in 1838, but did not thoroughly establish the trade till ten years later. At first no anchors weighing above 1 ton were made; but eventually this weight was greatly increased, and one for the Great Eastern, forged at Tipton, was over 7 tons weight. The application of the steam-hammer to this branch of manufacture has wrought a great change, so much so, that old Mr. Hingley says he can remember anchors selling in Liverpool 40 years ago for about 3*l.* per cwt., whilst now the same description will only fetch about 16*s.* per cwt. An anchor that formerly took three days to make can now be manipulated under the steam-hammer in less than one, so that both time and labour are saved. Coming to the chain shops at Messrs. Hingley's. In the first there are 14 fires, having a man to each, and for the larger sizes the man is assisted by a boy. Chains are made here up to ¾ in. In shed No. 2 chains are made from ¼ in. up to 1⅜ in.; and there are 13 fires, and the same number of men engaged, some of them having two boys each. There are 16 fires, and 16 men employed in the cable shed, and as many as three or four boys are engaged with the men who make the largest sizes. The cables are made up to 2¾ in., and in the links of the heavier ones cast-iron studs are placed, to give additional support.

A very fine hydraulic machine, by Tangye Brothers, is used for testing the chains and cables. In the department where the chief portions of the anchors are forged there are two 50-cwt. steam-hammers and three heating furnaces, and in the anchor smiths' shop about twelve fires, with a smith and several strikers to each. Anchors are made from about 10 lbs. up to nearly 5 tons each, and of a quality that can scarcely be surpassed. There are a variety of patent anchors, and these are all made here, from the plain common one, in which the arms and palms are welded together by the smiths, to the most elaborate swivel anchors, in which the palms are forged out of the solid mass of iron that composes the arm. The strongest anchor made is one in which the shank and arms are flat instead of

oval, with solid palms, and plenty of substance left near where the arms are welded on to the shank, the weakest part which is generally the first to give in the common anchors. The whole of the chain and anchor fires are supplied with blast from a large fan, about 8 ft. diameter, driven with straps from a vertical engine, with 16-in. cylinder and 3-ft. stroke. There are two foundries connected with the works, a small one, with a cupola, in which the studs for the cables are made, and a larger one, with two air furnaces and a cupola, from whence is turned out all the machinery castings for the works. The whole of the repairs are done by a staff of men employed by the firm, and there is a compact little fitting-shop for these, containing two lathes and a drilling machine, driven by a small horizontal engine.

CLEVELAND:

ITS PAST, PRESENT, AND FUTURE, IN RESPECT TO ITS MINERALS AND MANUFACTURES—NO. II.

[*Continued from the Supplement to the Mining Journal of Oct. 28.*]

We have traced the development of Cleveland down to the year 1865, when we are to witness in that district a state of unprecedented activity in every branch of industry. The position the district had attained was of the highest importance to the Staffordshire iron-manufacturers, against whom was arrayed a band of persevering men, who had many superior advantages, and who never lost any opportunity for to enter the markets. Yet they regarded their efforts as feeble; the result we shall notice subsequently. The idea of erecting blast-furnaces of a large capacity, with the view of economising fuel, increasing the yield proportionately, and reducing the cost of production, by a saving in the consumption of material and in labour, was ridiculed. Many were the bolts hurled at the Cleveland iron manufacturers by their long-established rivals, but fortunately they fell harmless; indeed, they incited them to renewed efforts. Hitherto the blast-furnaces of Cleveland had been erected on a similar plan to that which had been adopted in Staffordshire, Shropshire, Wales, and Scotland many years, and which at this time was still believed to be the acme of perfection. In Cleveland it was otherwise. It may be interesting to sketch the progress of Cleveland in this one subject. Other districts had adopted blast-furnaces ranging from 40 to 50 ft. in height; here larger furnaces were introduced.

In 1840 in Scotland, at the Govan Works, there was a furnace 45 ft. high by 15 ft. 8 in. diameter, with hot-blast 3-lbs. pressure, and having five tuyeres, the make of which was from 140 to 150 tons of pig-iron per week. About the same period we find Mr. John Gibbons, of Corbyn Hall, Staffordshire, erected a furnace 50 ft. high by 14 ft. diameter, the largest diameter being about 30 ft. from the hearth, the diameter of the throat being 8 ft., and having four filling or charging places. The furnace had a cubical capacity of 4850 ft., and yet the production of iron was only 115 tons, with cold-blast at 1 lb. 13 ozs. pressure per inch. Scotland has never been at a loss for men of genius, and her sons' inventions have contributed something towards the perfection of blast-furnaces. At Muirkirk a furnace was erected 40 ft. in height, and the boshes were reduced from 10 ft. to 8 ft., but it was proved that the results were inferior as compared with the larger bosh. Other firms, however, were more successful. Nor was Wales without men who were giving the subject their serious attention. In various places great changes had been effected. It is true many of them did not meet the expectations of the firms, but then we must remember that all cannot be smooth sailing, all cannot be an unbroken line of successes, there must in all matters be much that is adverse to our desires. The Welsh furnaces varied in height from 40 to 50 ft., and had a capacity of from 5000 to 7000 cubic feet. This class of furnaces worked tolerably well. Others were erected with a larger capacity, but signally failed, owing to the insufficient knowledge which the firms had of the management necessary in this kind of furnace.

With such instances before them Cleveland firms had a better opportunity for observing the rocks to be avoided, and had gained experience which would be exceedingly useful in their endeavours to improve their furnaces. Messrs. Bolckow and Vaughan's furnaces at Middlesborough, in 1853, were 42 ft. in height by 15 ft. diameter across the widest part. At Eston Junction they had several furnaces 45 ft. in height by 15 ft. diameter. Messrs. Gilkes, Wilson, Leatham, and Co., of the Tees Side Ironworks, had two furnaces, 45 ft. by 14 ft. diameter. Those furnaces are named as representing the size generally adopted at that time. The average capacity was 3825 cubic feet, and the hot-blast was from 400° to 500°. The make of a furnace was 80 to 100 tons per week, with a consumption of 42 cwts. of coke to the ton of iron made. In order to prove that the firms in the district under notice were laying hold of every invention of known value, we may mention that Messrs. Bell Brothers, who were building two furnaces at Port Clarence Works, Middlesborough, 40 ft. in height and 16 ft. 6 in. in diameter, and open-topped, resolved to make them of a capacity equal to 5700 cubic feet. In those was also introduced the principle of collecting the gases by chimney draught through holes in a circular flue at the top of the furnace, which, however, was not a novelty, but merely the adaptation of a plan then in use at Pontypool and other parts of Wales.

Some few months elapsed, during which time every result was carefully noted by those around, and then Messrs. Cochrane and Co., of Cargo Fleet, began to erect furnaces of yet larger capacity. Those were 54 ft. in height and 16 ft. diameter, and a cubical capacity of 6150 ft. The next year the furnaces of Messrs. Holdsworth, Benington, and Byers, at Stockton-on-Tees, were commenced. From 1853 to 1857 there were few changes in the construction and height of blast-furnaces, but in the latter year the late Mr. Archibald Slate erected the Jarrow furnaces, which were 60 ft. by 18 ft. 6 in. in diameter. A year afterwards Messrs. Jones, Dunning, and Co., of Cargo Fleet, Middlesborough, commenced to build two furnaces 58 ft. by 17 ft. diameter, and a capacity of 8000 cubic feet. It might be not unreasonable to ask whether the highest point was not reached, seeing that those were considerably larger than the furnaces erected in the same district only two or three years ago. It was not, however, the fact. It was the intention of the firm to make the furnaces 65 ft. high, but the cost had to be considered.

We pass over many others erected about this period, inasmuch as they do not offer any special point of interest, and notice the Thornaby Furnaces, erected by Messrs. W. Whitwell and Co., of Stockton-on-Tees, a firm possessing great energy, and not slow to adopt real improvements in works for the manufacture of iron. Two furnaces were erected there in 1862, which were 60 ft. in height by 20 ft. diameter at the boshes, and one of Messrs. Bolckow and Vaughan's Witton-park furnaces was raised to 63 ft. in the same year. Cleveland ironmasters looked upon those with especial interest. It was a change unheard of previously, never thought of by them, and doubted as regards its practicability, as most other new schemes are till they are fairly proved. History repeats itself continually in this respect. It informs us how Galileo's opinion was not believed, how Watt's discoveries were questioned, and how Stephenson's steam-horse was not readily accepted, although it met, perhaps, the greatest want of the age; but it is invariably the case. In this manner our most splendid achievements have been received. Nor do we grow wiser. Were we to learn to-day that a tunnel could be easily constructed between England and America, by which we might reach our Transatlantic cousins in two or three days, few persons would believe in the practicability of the scheme, or were we to learn that the locomotives and railways might be superseded by some newly-invented plan of travelling through the air, our inventor's scheme would be considered "airy." Yet human nature is human nature after all our arguments. This was precisely the case with Cleveland ironmasters in reference to the increased capacity of the Thornaby furnaces. They even (notwithstanding their constant efforts and earnest endeavours to advance in everything proved to be really valuable) failed to observe how this great increase in the capacity of the furnace could be an advantage. Time set at rest any doubt on the point. There was now only one opinion—all were unanimous. Messrs. W. Whitwell and Co.'s Thornaby furnaces were now the model of the district, and the largest in Cleveland. Their capacity was about 11,500 cubic feet, and, as a natural consequence, the consumption of coke was considerably reduced. Previously there had been 35 to 42 cwts. of coke used per ton of iron made; now it was only 25 to 30 cwts., and the make of iron had increased from 180 tons to 250 tons per week per furnace.

Cleveland was, therefore, adopting a plan which enabled her to meet other iron-producing districts on the same platform. Cleveland was developing itself by this and similar improvements in systems. Staffordshire, Shropshire, Wales, and Scotland were comparatively indifferent to those matters. She was travelling at express speed; they were still in the old mail coaches, and secure, as they thought, from harm. The Spanish Armada was powerful, its commanders were confident of success, yet it failed. France, in like manner, was strong, and feared no enemy, and at the outset in the recent war her leaders were certain of victory; yet she was defeated. Those other districts had confidence in their own resources and century-old appliances, and in their long established business connections, and they, therefore, regarded with amusement rather than anxiety the position which Cleveland occupied. They were strong as Goliath; they never thought of David's power. Hence we find that whilst Cleveland was constantly endeavouring to secure the most approved inventions, and was thereby gaining a superiority, other districts rested upon their oars.

Of the many useful inventions first introduced into this locality we ought not to omit to mention the patent pyrometer of Mr. Gauntlett, of Middlesborough, for indicating the high temperatures of blast-furnaces. This invention was exceedingly valuable, and aided the ironmasters very materially in ascertaining how their furnaces were working at given periods. It registered with accuracy.

Directing our attention to the further development of blast-furnaces, we come to a period two years later. The Thornaby furnaces were 60 ft. by 20 ft., and although only two years had gone many of the firms had erected furnaces 10 ft. higher, and, indeed, this was the general dimension throughout the entire district. The old pattern of blast-furnaces had disappeared—had retired in favour of much larger ones. In 1863 and 1864 the furnaces of Messrs. B. Samuelson and Co., at Newport, Middlesborough, were built 69 ft. in height by 20 ft., and those were followed by many others 70 ft.

At this point it may be of interest to compare the progress in the development of blast-furnaces within the Cleveland district between the years 1853 and 1863—a period of ten years. In 1853 furnaces were built only 42 ft. in height and 15 ft. diameter across the widest part; in 1863 they were built 70 ft. in height by 20 ft. diameter. In the former year they had a capacity of only about 3700 cubic feet; in the latter they had a capacity of about 14,000 cubic feet. It is, therefore, evident great progress was made, and was the result of careful observation on the part of engineers and firms within the district. Those results were not obtained without difficulty and considerable loss in a pecuniary point of view, nor indeed are any facts easily obtained which are of value. We could enumerate many gentlemen who devoted special attention to this highly important subject—the advantages of a development in the capacity of blast-furnaces—whose services should be appreciated, inasmuch as we are indebted to them for our successful results in the limits of blast-furnaces. For the present we shall not mention those keen observers, but hope to do so in a subsequent article of this series.

[*To be continued in next week's Mining Journal.*]

MINING IN NORTHAMPTONSHIRE.

Great as has been the increased production of ironstone in Northamptonshire during the last few years, preparations are now being actively forwarded for opening out several extensive fields in different parts of the county. Several new blast-furnaces are also about to be erected, and there is every probability that in the course of a couple of years the output of iron will be nearly doubled. At the present time the number of blast-furnaces is 11, although for 1869 Mr. Hunt puts the total at eight only. Messrs. Butlin and Co. have four, three of them being in blast, the Glenden Company three in blast, at Stowe, near Weedon, there is one out, and at Lower Heyford, also in the Weedon district, Mr. Plevins has three in blast. The last-named furnaces were amongst the first started in the county, and were for a long time in the hands of Mr. G. Pell, who is at the present time the lessee of a very extensive field of ironstone. The furnaces are 50 ft. high, about 18 ft. in the bosh, worked with five tuyers. They are all iron-cased, and the gas is taken from the top for heating the stoves and boilers, a great advantage at all times, but more especially where the coal has to be brought from a long distance. The stack is 150 ft. high and 7 ft. diameter inside. There is a blast-engine of 80-horse power, and two of 60-horse power each. The average output of iron from the furnaces is about 66 tons every 24 hours, or 1850 tons per month. The ironstone is brought a distance of four or five miles from Blisworth and Gayton, by both rail and canal, the works being advantageously situate between the two. The stone used is of full average quality, and the iron is in excellent demand for various manufacturing centres, including Staffordshire. A good deal of the fuel used, of course, comes from distant coal fields, Mr. Plevins being a colliery proprietor in Derbyshire.

The furnace at Stowe has been out for a considerable time, but the ore in connection with it is being worked. A large quantity of stone is also being raised at Blisworth and Gayton, and sent over the London and North-Western to Staffordshire and South Wales. The extent of the ore in the districts named has not been defined, but there is no doubt that it extends a long way, until it reaches Banbury, in Oxfordshire, where it is now being raised. The want of direct communication to Daventry, Southam, and other places in the same district, has long been felt, seeing that valuable deposits of ironstone could be advantageously worked in them, and as far as Welford and Rugby, were there ordinary railway facilities. But, singular as it may appear, Northampton has only a branch line from the main line of the London and North-Western Railway, so that the passengers going either to London, Birmingham, Manhester, &c., by it have to change at Blisworth, four miles distant. But that state of things is not likely to last, seeing that the Midland Company will before long have their Bedford and Northampton line completed, and will then be in a position to make a direct line to Weedon, eight miles, running through vast fields of iron ore. From there to Daventry is only four miles further; and a line between the two was projected some time since, and after half of it had been laid it was abandoned for want of capital, but the two miles are still intact. Were that line and one from Northampton connected together, the two might be extended a very few miles further to Harbury, and there join the Great Western. By that means there would be a new route direct from Birmingham to Northampton, Wellingborough, Bedford, and several other important places, without changing as at present. The vast beds of ore lying on the route of the new line would be developed, and as they would be in closer proximity to Birmingham, Staffordshire, and South Wales than those on the London and North-Western, would ensure for the Midland and Great Western an immense mineral besides the general and passenger traffic. Some such line as indicated must before long be proposed and carried out, and would not only be hailed as a most valuable boon by several important districts, but could not fail to pay well.

In the town of Northampton some very good ore is being raised, and is found in many places in sinking foundations, and a new field will shortly be opened at Bozeat.

At Wellingborough a very large tonnage is being raised, Messrs. Butlin and Co. having orders, or rather contracts, in hand to the extent of from 8000 to 10,000 tons weekly. The firm has now close upon 1000 wagons constantly on the move, with 12 engines, three of them being locomotives. So great is the demand that a large tract of ground, on the estate of Mr. Arkwright, of Knuston Hall, has just been secured by the firm. It is situate near to Irchester, confirming the opinion we formerly expressed that the ore would be found nearer to Bedford than it has been worked. The same parties have also taken a very extensive field of stone at Ringstead, on the London and North-Western. The stone found on the last-named estate being probably the finest to be found in the county, a specimen shown to us having yielded on analysis no less than 56 per cent. It is expected that ore will be sent from Ringstead by the close of the present week. One of the great advantages of the ore of Northamptonshire, it may be said, is that it does not require calcining, but yields a large percentage of iron from the furnace in its raw state. Rails are being laid down in all directions on to the Midland, whilst the great increase in the demand has led to the opening out of fresh fields, as one firm alone is now raising as much ore as was the whole of the county some three or four years ago.

At Finedon a large business continues to be done in stone for Derbyshire whilst the furnaces are kept in blast. At Woodford, near to Thrapstone, where the stone on the estate of the late General Arbuthnot has been worked by the family, it is said that two blast-furnaces are about to be erected. In the same locality new ground will shortly be broken, and the production of the district very largely increased. At Market Harborough, also, the ore will be shortly worked, and as the site for some furnaces was marked out some years since on the Holte estate, the time is is evidently not far distant when iron will be produced in that locality. Two furnaces are about to be erected near Islip. The actual production of ironstone in Northamptonshire during the present year will greatly exceed that of the year 1870, whilst the rate of increase will be found in 1872 to be larger than almost any other mining district in the kingdom.

IRON, AND THE IRON TRADE.

Everybody is supposed to know what iron is, but it is really surprising how very little the generality of even "highly educated people" know about iron. In early childhood a few practical lessons and expressions are learned, which remain as bits of knowledge scarcely worth the keeping, unless peculiar circumstances in life call forth enlarged enquiry. A baby puts its tongue against the knob of a poker and revolts at its nasty taste, a plain expression, which in after life is refined into chalybeate. The boy soon notices that "fire-irons" in the damp get covered with a brownish coating, called by the housemaid "rust," refined in truth by chemists into oxidisation; that after being rubbed it is capable of a brilliant polish. But, perhaps, the proudest moment of a boy's life is that when "Aunt Jane" presents him with his first "knife." What an influx of confidence all at once! The sharp blades of this knife, "the best *steel* ever made," very soon starts a series of interesting "whittling" experiments, and it is impossible to say how many channels of new thought the little knife carves out, or what bias may be given to the future course of the boy's life. The knife will "cut," and why should not the little philosopher try a very easy experiment upon mamma's new "Collard." Those rosewood legs look very tempting, are they real? Let's see whether they "shine all through." A notch in one of the legs is all that is required, and the secret's out. Mamma calls this budding of ingenious observation "mischief," and she forthwith "whacks" young genius accordingly. When next he passes by a village smithy he sends a furtive glance right in at the door or window, and watches the brawny arms beat out the yielding iron, hot and glowing, amidst a halo of brilliant stars. A horse-shoe made, is plunged into a water trough and hisses. There, observant lad, is a solid lesson for you, common enough seen, but little thought about. It is not usual to call it one of the "precious metals," because it is so very plentiful, and, as a rule, things are only called precious when they are scarce. But some folks, however, are inclined to think those things to be the most precious that cannot be done without, and inasmuch as we cannot very well do without iron, and can do without most other metals, it ought to be held in the greatest esteem, although it is found in the rocks of the earth almost everywhere, and in plants and animals almost always.

Iron is the most accommodating of all the metals; when in a molten state it can be moulded into almost any form; it can be drawn out into wire of almost any length and fineness; it can be extended in plates or sheets of almost any thinness; it can be twisted and bent in any direction; it can be softened and hardened, beaten out, and sharpened and blunted at pleasure. Our wishes, wants, needs, and even our whims and fancies, are supplied by iron and its multitudinous manufactures. It is obsequeous enough to bend to our necessities. We think but little of our indebtedness to iron, and less of ironstone, the source of iron. It seems trite to speak in this enlightened age of its uses. We dig, plough, sow, reap, mow, gather, thresh, and winnow; bake, boil, roast, fry, broil, stew, and even eat by the help of iron. We girdle the globe with iron roads, and extend our life by the annihilation of distance, and have come to reckon length by minutes instead of miles. The scissors and the needle prepare our vestments of every texture and pattern; we send our iron steamers across the ocean to peer into or run up the rivers of the world, to carry out and to bring home thought and stores for interchange, until our exports and our imports exceed almost those of the rest of the nations put together. A watch spring, worth nothing intrinsically for its iron, is worth almost anything in the regulation of the world's time divisions and its movements. The little graver, chisel, and the plane, the axe, the hammer, and the saw help fitfully to fashion and to make our fastnesses; the chain and anchor make securities of infinite value; the compass is the second conscience of the mariner; the sword, the rifle, the cannon and the bomb make death-havoc when the nations war for "balances of power," or for an "idea." The stretched-out wire reaches to the utmost Ind by a lightning road, so that people can flash their thoughts almost everywhere in a day. Over the earth a telegram and under the sea a cablegram pass instantly the tidings of our commerce. Our doctors tell us that iron is the only metal on friendly terms with the human frame, and he steels our nerves with its medicinal virtues accordingly; and, lastly, as if to supplement the iron treasures of the earth, the clouds at intervals drop iron meteors.

A beneficent Creator designed this vast profusion, and in the preparation of this globe's crust scattered these materials for His creatures' use. Man can go nowhere without finding iron. It is found where no men live, that man may search for it, and stay there or depart, as suits him. It is found in places inaccessible, and in places of easy access, yet far from coal and wood to melt it. Sometimes it is too poor to melt, at other times it is too rich to melt alone, and has either to be carried to some poorer ores, containing other virtues, in the neighbourhood of coal, or the poorer ores have to be transferred to it, so that the distribution of labour is healthful and otherwise beneficial in its operations. It is very curious to watch the movements of iron ores from place to place—dead corpses going to a funeral fire, to come forth again in a more glorified estate, to move and regulate the life of earth, both vegetable and animal. There are, it may be, 370 varieties of iron ores: there is, however, such a strong family likeness amongst them, that sometimes distinction can scarcely be called a difference. The mineralogist affects to see a difference, but the ironmaster and his men are blind to all its beauties, and only realise beauty in the percentage of metallic iron that can be extracted therefrom. Sometimes rich ironmasters get a hint that they are creeping out of the boundary of appropriate constituents, and are entertaining enemies unawares, who, if not resisted and thrust back, will bring a blight on all their labour; but often they think success an exact equivalent for skill, and tread upon the toes of safety—they lean to virtue's side until they topple over.

Of the arsenates, arsenides, carbonates, chlorides, chromates, oxides, phosphates, silicates, sulphates, sulphides, titanates, tungstates, vanadiates of iron, and the native iron, and the meteorites, only some ten or a dozen in all are worked by the miner for the metallic iron that can be got from them, or for some other ingredient of commercial use. Meteoric ores are found, like angels' visits, few and far between. One fact regarding them, however, is curious—they always introduce to the inhabitants of earth some of their rich relations. They come down though occasionally in tolerable big lumps, of a ton weight, and set us pigmies wondering what their little game can be, and whence they came. Passing over the sulphides, &c., as of no commercial value as iron ores, we will barely mention the black oxide of iron, or magnetite of Sweden, the steel-producing iron of that country, and glance at hematite, or blood-like iron ore. This is one of the most abundant of iron ores; we have it plentifully in Cornwall, Devonshire, Wales, Cumberland, Antrim, and Perthshire. Red hematites abound in Lancashire, Cumberland, and the Forest of Dean. The ore of the Forest of Dean produces iron, known in the market as red-short, and is especially celebrated for the manufacture of tin-plates. The hematites of the Whitehaven district are now in high favour, and their adaptability to the production of Bessemer steel has advanced their value greatly. Derbyshire and Somersetshire produce hematites, but not equal in quality to that of Lancashire.

Brown hematites (containing water) were for a long time thought comparatively of small account. Being of a rather low percentage they were blown upon as tending to cold-shortness, and chiefly suitable for foundry purposes. Some of the brown hematites contain a considerable quantity of manganese, and it is not a little remarkable that the iron ores of the oolite, &c., which less than 30 years ago were

rejected as useless, should now be in such demand that the present supplies are inadequate, and that some makers of iron have sold forward for the whole of the coming year. So unprecedented in the history of the world is the expansiveness of the iron trade at this moment that it is simply impossible to supply the increasing wants unless fresh sources are opened up, and to do this the oolitic formation should be followed further south. Northamptonshire and Leicestershire must forthwith be pressed into the service, and made to furnish liberal contributions from the enormous beds of ironstone underlying the very fruitful top soil. It is not a necessity that we should import any iron. We can find plenty for the whole globe, for the matter of that. The prime "brands" of England have fixed the world's standard of pig-iron. Foundries voraciously demand the cheaper irons from the cheaper ores, and the oolite can find it in any quantity, and at a cheaper rate than any other locality in the world. This being so it is marvellous that surplus capital, or some of it, is not made to flow in that direction, to stem this tide of foreign invasion.

It is interesting in the extreme to follow out the progress of iron smelting, but not our present purpose. We may, however, recur to it before long, because the subject, taken as a whole, is of paramount importance. It is a prominent feature in the discussion of iron just now to inform the uniniated of the effects of phosphorus and arsenic as to its deterioration, or otherwise. Phosphorus is probably never wholly absent from crude iron; it is said that where it exists only in small quantities it rather improves the iron for castings, because it imparts the property of tranquil fusing, but in larger proportion the iron is weakened. A small quantity of phosphorus is said to harden bar-iron, without influencing much its other properties; but when it exceeds 5 per cent. the bar becomes cold-short, or brittle. Schafhaeutl says cast-iron and steel are improved by phosphorus and arsenic; arsenic he found in the Dannemora and Low Moor iron, and phosphorus in the famous Russian (C C N D) iron. Silica and manganese occur sometimes in considerable amount in some of the popular iron mines. Smelters often make complaints about their being in excess, yet it is very singular that they should be always ready to purchase when it is in the market for sale. One fact is perfectly clear—we have in this country plenty of ironstone in convenient localities. The present supply of ironstone, both red and brown hematite, is far below the requirements of the trade, and the furnaces are gaping widely for more and more.

When, as we have seen above, that iron enters into the very soul of business life, there cannot possibly be any falling off in the demand; but, as men multiply, then old wants will increase, and new wants will arise, whilst the wear and tear of old iron will increase in proportionate ratio. A glance at the manufacture of pig-iron will be looked upon with much interest by those of our readers who are chiefly concerned in copper, tin, and lead mining. In Great Britain, in 1869 (no later returns published), there were 600 furnaces in blast. Nearly 11¼ millions of tons of iron ore were smelted, and valued at nearly 3¾ millions sterling. The pig-iron produced was nearly 5½ millions of tons, and valued at 13⅜ millions sterling. This wonderful total was largely increased in 1870, and has been still more augmented in the present year.

It is worth while here to note that in the Cleveland district, 32 years ago, a cargo of brown hematite was sent to the Devon Ironworks, at Allon, for trial, and reported as worthless; and that some landowners at the present time are netting from 30,000*l.* to 50,000*l.* a year royalty, and it is anticipated that the next year's Cleveland make will be two millions of tons at the very least. It will suffice now, to complete our case in favour of energetic efforts being made in the direction of iron mining, to make a few remarkable extracts of iron and steel exports from the Trade and Navigation accounts of the United Kingdom for the ten months of this year ending Oct. 31:—

Pig-iron for the ten months	Tons 900,911	Value	£2,750,289
Bar, angle, bolt, and rod	293,021		2,417,833
Railroad, of all sorts	846,606		6,877,784
Wire (except telegraph)	21,009		362,768
Hoops, sheets, boiler and armour plates	165,363		1,947,568
Tin-plates	101,474		2,437,433
Manufacturers' (except ordnance)	203,353		2,980,188
Old iron for re-manufacture	119,809		576,888
Steel (unwrought)	31,729		970,232
Steel (manufactured)	11,013		562,617
Totals of iron and steel	2,694,379		£21,883,600

The exports of iron in Oct. exceeded by 28 per cent. those of Oct. last year.

OUR COAL SUPPLY.

SIR,—The letters of your correspondents, "A Mining Engineer" and Dr. Holland, contain much interesting matter, and it is by such discussions that those who are desirous of becoming acquainted with the progress of mining science become aware of what is being done in reducing the difficulties in extracting coal, whereby a full supply may be maintained, at such prices as will not operate seriously upon our manufacturing prosperity.

The Report of the Royal Commission, so complete in many respects, is singularly incomplete upon one branch of the subject—the application of machinery. Only one witness—Mr. Lindsay Wood, who has had practical experience with compressed air machinery—was examined by the Commission. Dr. Holland has, in your last issue, called attention to the probable effect of the use of compressed air in coal mining; and having devoted many years to the study of the subject, I have no hesitation in expressing my opinion that it will prove *the* means whereby the getting of coal at great depths at moderate cost may and will be effected. It is an erroneous opinion to suppose that compressed air as a motor is a costly power. The fuel of a coal pit before being transported is of less money value by 50 per cent. than it is in almost any of the great centres of manufacturing prosperity, and there is really no valid ground of objection to its extensive use on that score. The statement made by Dr. Holland is correct, that the working of machines for cutting coal by compressed air does not sensibly diminish the temperature of the working faces, and that it may be transmitted with little loss of force to great distances (miles). The cooling effect of the temperature may be easily estimated. Take a working face passing 20,000 cubic feet of air per minute, the normal temperature being 98° of heat, with a discharge of air from the coal-cutting machines at a pressure of 45 lbs. to the square inch of 666 ft., equal to 2000 ft. in its natural expansion, and at the temperature of 32°, would give a reduction of 9°, giving a mean temperature of 89°, at which heat manual labour may be exerted with comparative comfort during moderate "shifts" of six or eight hours.

The exhausting labour of a coal mine is the "hewing," but on the "long-wall" system of working 90 per cent. of this may be cut by machinery. "Drilling" will be done by the air-engine, and gunpowder will be supplanted by the hydraulic pump. Hurrying will be done entirely by the compressed air-engine, and some means may be devised for filling the corves with more ease. The "bye-work" is generally of a light character, and it will be the severest manual labour in a coal pit. I, therefore, concur with Dr. Holland that coal is not likely to be scarce, and that at depths approaching 3000 feet would not be materially increased upon the present cost of working corresponding seams of a depth of 1500 to 2000 ft.

Nov. 9. W. FIRTH.

FUEL FOR THE WINTER.

SIR,—The pressing demand for coal for both domestic and manufacturing purposes is being felt at this early period of the season with an intensity almost unprecedented, and I think it is not too soon for us to ask ourselves the question—From what source our winter's fuel is to be looked for?

The increase of our railway traffic has brought up the demand for locomotive fuel considerably in excess of the estimates, the aggregate consumption of coal and coke by the iron furnaces and other iron manufactures of the country must be going on at the rate of, at least, 20 per cent. more than the consumption for these purposes 18 months ago, and gas companies, and all branches of manufacture sharing in the general prosperity of the country, are using fuel in quantity much above the average. The consequence is that some of the coal usually available for domestic consumption has been taken up for other purposes, either in its raw state or converted into coke, by contracts extending through the winter.

The merchants' wharves in London, as well as in the country, are already as naked of stock as is usually the case in January; therefore if, of fuel, something very like famine prices are not experienced in the event of severe weather there must be large supplies forthcoming of the source of which I am not cognisant. Two advances in prices at the pits have already been effected this season without checking the demand.

As regards the metropolis, I am afraid this state of things has been somewhat contributed to by some of the railway companies having recently withdrawn many of their wagons from the coal traffic, and turned them into the goods traffic. The Great Northern Company has hitherto supplied rolling-stock to the collieries on their line at a lower rate per ton than the collieries could afford to supply themselves; hence, in a time of pressure like the present, some collieries are left with means of transit insufficient to supply their wants, and being thus unable to bring their vend to market their pits have to be put upon short time in some cases. Altogether the demand for fuel for all purposes, domestic as well as manufacturing, was never known to be more general or greater than at present, and the period of the year, coupled with the almost total absence of stocks, point to the strong probability of an early scarcity, which the excited state of the labour market tends in no way to alleviate.

COAL MERCHANT.

THE MINERAL WEALTH OF MONMOUTHSHIRE.

[We have been requested to publish the following letters in the Journal, which were addressed to the Editor of the *Monmouthshire Merlin*.]

SIR,—Some years ago a great and important project, connected with the mining interests of Monmouthshire, suggested itself to my mind, but I refrained from publishing any account of it because I thought that, being at that time without precedent, it would be considered as of doubtful practicability, and, therefore, unworthy of any serious attention. The gigantic system of London drainage (now nearly, if not quite, accomplished), the Underground London Railways, and the triumphant completion last month of the Mont Cenis Tunnel, afford now precedents in every point of view satisfactory for the justification of my project. I request, therefore, that you will be kind enough to allow me to make it known through your useful and widely-circulating Journal.

I propose that a company should be formed and incorporated by Act of Parliament, with all necessary powers, under the title of "The Monmouthshire Mines Draining and Underground Railway Company." The primary object of this company will be to do away with the necessity of all pumping engines in such of the Monmouthshire iron and coal mines as shall be capable of being comprised within the scope of its natural drainage power. This natural drainage will consist of a capacious tunnel or underground water-course, to commence at such a distance from Newport as that it will arrive at and intersect in some part of the Western Valleys the lowest workable vein or seam of mineral deposit in the lowest point of the Monmouthshire mineral basin, which is supposed to be near Crumlin. From this point, which would form the main artery of drainage (and to which a capacious pit should be sunk from the surface for ventilation purposes), smaller tunnels could be extended inwards in the same vein to the lowest boundaries of all the different works from Cwmbran to Pontypool and Blaenavon, and from Blaenavon to Rhymney. By means of bore-holes, pits, or levels, each work would thus be enabled to collect and discharge the whole of the water emanating from its mining operations through the tunnels of the drainage company. In making the communications from the different works to the tunnels many useful discoveries might be made, and they might be used in some instances to assist ventilation.

The yearly saving in engine power will be enormous, and the owners of mines, relieved from all anxiety about the drainage, would, of course, be ready and willing to pay a handsome tribute to the drainage company, whose outlay might be kept to a very moderate figure, and calculated to a nicety, by agreement with responsible contractors, such as the Messrs. Brassey. Sir William Armstrong might probably be induced to assist in planning and directing the works, and as the water issuing from the tunnel would belong to the company, and would be available for various hydraulic purposes, no man could be found in England whose advice would be more valuable as to its most lucrative and beneficial employment. At Mont Cenis there is a capacious water-course, as a necessary adjunct to the railway. By my project a railway will be a useful, but not absolutely necessary, adjunct to the water-course.

If it should be thought desirable, and the Monmouthshire Railway Company would take a large interest in the drainage concern (as they ought to do, seeing that the facilities afforded by the latter would be certain to produce a great and immediate increase of their surface traffic), an underground railway might be provided in connection with the tunnel, and either made at their expense or let to them on reasonable terms. This would be another source of income to the Drainage Company, without necessitating any very great increase of outlay.

It is almost superfluous for me to point out what an immense advantage would arise to the owners of deep-lying minerals from such a tunnel and railway, nor what an extensive area of land it would embrace, turning the earth, as it were, downside upwards, and making almost immediately available mineral treasures that would otherwise be for years unutilised, like the "full many a gem of purest ray serene," which "the dark unfathomed caves of ocean bear," according to the language of one of our poets, once very popular, now almost forgotten. Being now an old man, and quite unable to take an active part in carrying out the scheme above suggested in terms written *currente calamo*, I must leave it to take its chance according to the judgment of the many eminent, able, and distinguished men who represent the mining interests of Monmouthshire, such as Mr. A. Darby and his colleagues (directors of the Ebbw Vale Company); Mr. C. Bailey, and the director of the New Nant-y-Glo and Cwm Celyn Iron Company; the representatives of the Tredegar Iron Company; Mr. John Lawrence, of Cwmbran, experienced almost from his cradle in the underground workings of the Pontypool Valley; Mr. T. Brown (equally experienced in those of the Western Valleys) and the other directors of the Monmouthshire Railway and Canal Company; Mr. Cartwright, distinguished for his eloquence and clear-headed business qualities, and a large shareholder in most of the docks, railways, and other public works of Monmouthshire and Glamorganshire; Mr. S. Homfray (for many years manager of the Tredegar Iron Company, and who first discovered and brought into notice the superior qualities of the Tredegar steam coal), and the other directors of the Newport Dock Company; the Kennards, constructors of that noble and elegant fabric, the Crumlin Viaduct; Mr. John Russell, to whom the Black Vein of Risca is indebted for its high reputation as a steam coal; and many others equally deserving of mention.

I enclose an article headed "Compressed Air," which I have extracted from a late number of *Galignani's Messenger*, which seems to me a fitting supplement to my letter on the Monmouthshire Mines Draining and Underground Railway Company.

I have no doubt, if it shall please you to insert the article, that it will be read with great interest by all such of your readers as may be engaged or who may wish to engage in mining operations. It seems to result from the article in *Galignani* that by the proper use of compressed air any mine may be opened, drained, supplied with vital breath, freed from noxious vapours, and have its valuable contents extracted without any other danger to the workmen than of a sudden fall of roof, or the unexpected and violent irruption of pent-up water. As such a fall is generally the result of carelessness, and the dangerous influx of water an accident of rare occurrence underground, perils would by this agent be reduced to a minimum:—

COMPRESSED AIR.—The advantages resulting from the application of compressed air to the piercing of the Mont Cenis Tunnel have latterly revived the question of its more general adaptation to the wants of mechanical science. Water-power is only useful on the spot where Nature has provided it, and the problem consists in finding a force capable of replacing it, and also of being transportable from one place to another. Now air, compressed to half its bulk, has evidently a power of expansion (commonly and very improperly called tension) equal to two atmospheres; if reduced to one quarter of its bulk, it will neutralise the action of four atmospheres, and so on. If the air be thus compressed in a long pipe, it will, in consequence of the well-known principle of the equal transmission of pressure in all directions, exercise that power as well ten miles off as on the spot. Let us now suppose a powerful condenser, an apparatus much resembling an air-pump, but performing the contrary office of compressing instead of exhausting, to be set in motion by a waterfall or a stream; then air to the amount of many atmospheres may be forced into a reservoir of insuperable resistance, whence it may be directed to any place to which a pipe is laid, there to operate as a motive-power. The cheapness of the system is self-evident, the expense being confined to the cost of construction and occasional repair to the machinery and conduits. There is no necessity for coal, and no danger of explosion; the principal agent, the atmosphere, is everywhere at hand. Switzerland and Italy, where water-power is abundant, are now intent on carrying out this system, and applying it to various purposes, among which we may mention the pumping water out of mines. The enormous depth which some of them have attained is already a cause of great difficulty, the steam-engines used for the purpose being necessarily on the surface outside, on account of the smoke, and the connecting rods they work being of a length which it might be difficult to increase without exposing them to break by their own weight.

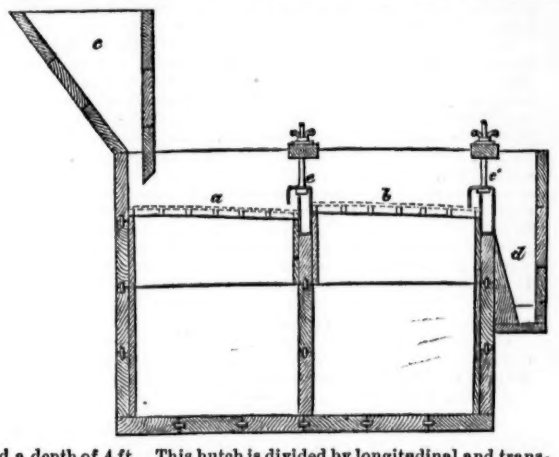
My project, as a whole, may appear gigantic, but gigantic also will be the results; 12,963,200,000 tons of coal only, worth at 6d. a ton only for galeage to the owners, 324,080,000*l.* sterling, contained within an area from east to west of 24 miles—from south to north of 16 miles. There remain still uncalculated millions of tons of limestone, fire-clay, ironstone, iron pyrites, and sulphurous shale (sulphate of alumina), all of which may be drained and worked by the proposed tunnels and railways. The ironstone at 6d. a ton will be more valuable than the coal. Almost every vein of coal has one or more attendant seams of ironstone, or ironstone in balls—the seams are from 6 to 8 in. in thickness, and the balls very large. An inch thick of ironstone makes about 1000 tons an acre, and about 3½ tons will yield about a ton of good pig-iron. Any one desirous of estimating the prodigious value of this mineral has only to ascertain the average number and thickness of workable seams, to multiply by 1000 every seam of 1 in. thick, and the result will show the number of tons per acre. The fire-clay, which is of the best quality, may be said to be inexhaustible. There are in some parts large quantities of iron pyrites (now the horror of our ironmasters on account of the sulphur they contain), but which at little expense may be converted into copperas—a product which is extensively used in dyeing black, especially hats; in making ink and Prussian blue, for reducing indigo in the blue vat, in the china blue dye; for making the German oil of vitriol, and in many chemical and medicinal preparations; some of which will be found described in the last edition of Dr. Ure's Dictionary, p. 1214. The use that may be made of the sulphurous shale and iron pyrites for the manufacture of alum, and the immense demand for that article, are fully described in the same work, p. 34. The limestone, various in quality, but infinite in quantity, may be employed either as a flux for the ironstone, or for building, agricultural, or other purposes. It is quite impossible to form the rudest estimate of the value of that which is said by the late Mr. Mushet, from actual measurement, to be of the thickness of 120 fathoms.

The late Baron James Rothschild, of Paris, is reported to have died worth 40,000,000*l.* sterling. If the mineral treasures of the South Wales coal field could be put in a train of more rapid realisation, our Duke of Beaufort, Marquis of Bute, Lord Tredegar, our Lady of Llanover (eminently worthy of the choicest gifts of fortune), our Herberts, our Baileys, our Lawrence, our Abraham Darby (that colossus of daring enterprise for the benefit of Monmouthshire, and well deserving of a statue to be erected on the heights of Twyn Barlwm) would each be richer than a Rothschild.

AN OLD MINER.

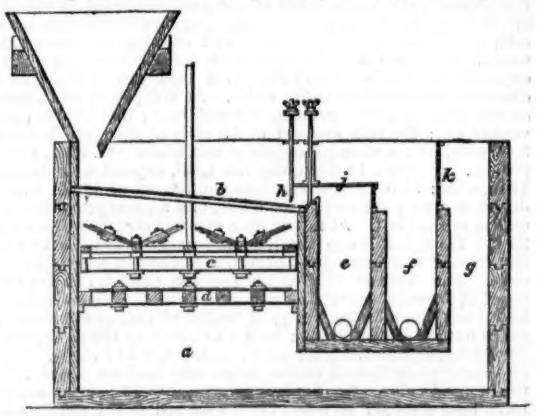
ORE-DRESSING MACHINERY—No. XIV.

THE EMS JIGGER.—At the extensive and well-appointed dressing establishment near Ems a two-piston continuous jigger is employed for concentrating lead and zinc ores. The apparatus consists of a wooden hutch, Fig. 1, having a length of 4 ft. 10 in., a width of 5 ft. 4 in.,



and a depth of 4 ft. This hutch is divided by longitudinal and transverse partitions, so as to form piston and sieve compartments. The sieves, *a b*, are 27 in. square, have a fall of ⅝ in., and are set from 8 to 9 in. from top of hutch. The sand introduced into the hopper, *c*, affords at the points of delivery from the first sieve, *a*, clean ore, from the second sieve, *b*, mixed ore, and from the hopper-shaped shute, *d*, stuff for the waste heap. The ore-discharging regulators, *e e*, are formed of a fixed sheet of iron covered with a movable cap, the raising or lowering of which increases or decreases the volume and percentage of stuff discharged within a given period. The width between the sheet-iron partition and cap is 1½ in.; width of cap 3 in., or 1½ in. overlap on the sieve; height of caps, 4½ in. Each sieve is in connection with a piston-plunger of wood 12 in. thick. The piston-rods are 3 ft. in length, and articulate on pins set in slotted discs. By means of this arrangement the stroke may be varied from 0 to 5 in. in length. Fast and loose riggers are fixed on the disc shaft for driving or stopping the pistons. A supply of water is afforded to each sieve by means of wrought-iron pipes fitted with common regulating cocks. Each compartment under the sieve is rendered accessible by a door kept in position by staples and gland. At the Erms dressing works trommel sizing is applied to the washed stuff as well as to sand resulting from the crushers and stamps grates. Slime sand, too fine for trommel separation, is classified by a well devised system of pyramidal boxes and expanding launders.

RITTINGER'S PISTON-PUMP JIGGER.—In the hutch, *a*, is a sieve, *b*, 3 ft. long and 18 in. wide, a piston, *c*, clack, *d*, collecting boxes,



e, *f*, and circulating water compartment, *g*. At the lower end of the sieve, *b*, is a regulating slide, *h*, set against a movable bridge, *j*, by which arrangement the quantity and quality of the orey product discharged into box, *e*, as well as that of the sand delivered into the box, *f*, are determined. To prevent the passing of sand into the water compartment, *g*, a sheet of perforated plate, *k*, is fixed across the hutch. The hydraulic action of this machine is that of an intermittent flow of water, the velocity and impulses being governed by the speed of the piston and number of strokes made within a given period. By this mode of working the grains are projected upwards, and fall according to the velocity due to their respective densities; whilst on the plunger method the specific fall of the grain is to some extent affected by the return of the water with the upward half of the stroke. The length of sieve is 36 in., width 18 in.; size of stuff

jigged from 2 to 6 millimetres; quantity of stuff jigged per hour, from 40 to 60 cubic feet; circulating water required per minute, 3 to 4 cubic feet; number of strokes per minute, 80 to 120, according to size of stuff; length of stroke, ¾ to 1¼ inch. In a modified arrangement of the jigger the sieve bottom is set perfectly flat; the outlet edge of the sieve is also depressed for a width of 8 in., length 5 in., depth 1 in. A sheet-iron slide fits into this hollow discharging-way, the lower edge of the slide being raised just enough to pass the diameter of the grains under treatment. About 1¼ in. of jigged ore may be kept on the sieve, and 2 to 2½ in. in the hollow discharging-way. If a greater thickness than this is maintained, particles of ore are likely to come under the action of the horizontal flow of water, and to be carried away with the waste sand. J. DARLINGTON.

2, *Coleman-street-buildings, London.*

RIVAL GAS ILLUMINATION.

SIR,—At a time when promising prospectuses of so many new companies are being published, and so many false statements set forth by directors of limited liability companies, it behoves the public, and intending shareholders in particular, to enquire for themselves into the validity of the statements which invite their launching out as investors. If prospectuses are false, directors we now know by the late decision in Gurney's case are liable, and *not* the unlucky shareholder, but always provided he has lost no time and let slip no steps for advancing his claim to restitution. The law can only assist a deluded shareholder on full proof of his immediate and unremitting attention in this respect to his own individual interest, otherwise, as in the case just decided, the law accepts his dilatoriness and negligence as amounting to perfect satisfaction with his enterprise.

1.—At present we have two rival schemes for gas illumination. Of these the earliest is that of Mr. GEORGE EVELEIGH, a consulting chemist, whose patents date Jan. 7, 1869, and Feb. 21, 1871. His process is one of slow distillation, first of the carbonaceous fuel, and then, passing thence into other retorts, of the vaporous and fluid products, carried on by a system of apparatus of his invention. In his last specification he very properly observes:—

"I am aware that a low temperature has before been employed to obtain a gas of high illuminating power and purity, but the methods heretofore adopted have not been *commercially* successful, chiefly in consequence of the small quantity of gas that could be produced by such means. * * * * I am also aware that attempts have been made to produce gas from hydro-carbon oils and tar, but heretofore they have been subjected to destructive distillation after their formation at a high temperature, whereby very much of their valuable gas-yielding qualities have been sacrificed."

I presume that in the first part here quoted the patentee chiefly alludes to the patent of Mr. James Young, dated Oct. 7, 1850, one of the most successful chemical operations on bituminous coals submitted to a process of slow distillation; producing both paraffin oil and gas, hence the process is not novel in a chemical point of view; and it only remains to be seen whether Mr. Eveleigh's patented invention absorbs the best possible mechanical arrangements, for to that, and that alone, can he apparently lay claim. Indeed, he professes only to do better what his predecessors failed to carry out as a successful "commercial" scheme; and yet we very much doubt this being a sufficient proof of the goodness or indifference of a patented process, as many fail in spite of every excellence short of being in business hands to work the matter practically.

2.—The other method is denominated the Oxyhydric Gas Light, the invention of M. CYPRIEN JESSIE DU MOTAY, a French chemist, who appears to have no English patent for it, unless it is included in his patent of May, 1868, for "preparing and employing zirconia;" and another of June, 1868, for the "Manufacture of Carbonic Oxide, Hydrogen, and Carbonated Hydrogen." As exhibited at the Crystal Palace, Sydenham, each gas-burner has a centre jet for the issue of oxygen gas, and is surrounded by jets of coal gas; or probably this system is reversed; however, the result, as might be expected by any chemist, is brilliant in the extreme, causing all the adjacent flames to look like the dingy flickering light of oil lamps. In a practical point of view every establishment employing this method of illumination should manufacture its own oxygen, but how otherwise it can be supplied is by no means clear. This scheme has, probably, been suggested by the well-known brilliancy attending the employment of the oxyhydrogen blow-pipe.

If these efforts serve to arouse our gas companies from their long admitted lethargy, it must be admitted they have not been projected without producing a large amount of public good. C. E.

London, Nov. 7.

SWEETWATER MINES, WYOMING, U.S.—No. III.

SIR,—As I mentioned in a preceding letter that I would be glad to furnish a description and a few statistics of some of the mines of this district, it is natural to select the oldest, and one which has shown some results, for the subject of the first article. I, therefore, select the CARISO MINE, the first quartz discovery made in the Territory. This mine is situated about ¼ mile north-east from South Pass City, the county seat of Sweetwater county, and was discovered June 8, 1867, by H. S. Readall, who located 200 feet; as under the United States law the discoverer of a quartz mine is entitled to that number —100 for discovery, and 100 by preemption. About 1000 feet more were immediately located by other parties, and the ledge struck on each claim. Mr. Readall commenced work on his claim taking out quartz by hand, and reducing it with a hand-mortar, gathering the gold by panning it out with the common gold pan; $130 per day to the hand was realised by this primitive method. Attracted by the glowing reports of the richness of this new mining country, and of the Cariso Mine in particular, Mr. Bolivar Roberts, of Salt Lake City, and an old Nevada miner, came and made an examination of the property, and succeeded in purchasing 25 feet of the Discovery claim, and immediately erected a mill on Hermit Gulch of 6-stamp capacity for the reduction of his own and what custom quartz the country would afford. As Mr. Robert's presence was required in Salt Lake, it became necessary for him to erect his mill and work his property through an agent; this continued for one year, and the agent succeeded at the final settlement in bringing the mine into debt $8000. Mr. Roberts then undertook the present management of the property, and in the space of one year succeeded in purchasing 375 ft. of the adjoining ground, and in paying all indebtedness on the mill, besides opening his property, and erecting necessary hoisting works. The main shaft of this mine is sunk to the depth of 210 ft., exposing a vein of ore 3 ft. in width, of good quality, free gold being discernable through its entire width. At a depth of 35 ft. from the surface there is a level running east and west; this level is partially worked out; the vein exposed at the ends of this level is from 2 to 3 ft. wide, with a strong free gold quartz leader 8 in. wide, worth $80 per ton. A winze, 14 feet under this level, exposes a similar leader, 14 in. wide: 95 ft. from the surface another set of levels have been driven to nearly the end of the claim, and a great proportion of the quartz worked out. At this depth a cap was struck, which extended 25 ft.; through this cap the lode was only discernable by the continuation of small strings of quartz, contained in a matrix of green slate. At a depth of 125 feet the cap was passed, and the vein exposed 2½ ft. wide, containing rich gold quartz. Several more levels have been run, all exposing good bodies of rich quartz ready to be taken out at 145 feet depth; level 65 ft. long at 160 ft. depth; level 25 ft. long, at 200 ft. depth; level running east 25 ft. long. The shaft on this property is sunk on the ledge, and inclines about 75° from the perpendicular. Good hoisting works, with 15-horse power engine, have been erected; no pump being attached as yet, but the addition will be necessary, however, for the further sinking of the shaft. The amount of ore exposed by this shaft and the lower levels is enormous. Calculations based upon the ore already in sight, ready for stoping, show the amount to be 30,000 tons.

As for the average yield of this ore, we are fortunately enabled to base our estimates upon practical results realised from the manipulation of a large amount of quartz by the Hermit Mill, as shown by the books of Mr. Roberts. During the year 1870 there was extracted from the upper levels of this mine 750 tons of quartz, which yielded by ordinary mill process 2234 ozs. 3 dwts. 8 grs., or (say) 3 ozs. to the ton of 2000 lbs.—109 tons of this amount yielded as high as $123 per ton. This amount of gold was sold for $52,183·92, at 4s. to the dollar equals 10,436*l.* 15s. 8d. This work was accomplished by 15 men in all, and the mill was only eight months in operation, the severe weather of the winter of 1869-70 causing a suspension of milling operations for the remaining four months. The cost of mining and reducing each ton of quartz so far has been $10, so that it is entirely unnecessary for me to go into any calculation to show that the net profits of this mine have been enormous.

Unfortunately, on account of the Cariso having been located as a segregated mine, each extension, so far as discovered, has been located under a different name. For instance, the property adjoining the original discovery on the west was located and is known as the "Young America," and that on the east was located as the "Irishman." The Young America has proved itself to be the same ledge as the Cariso, both by having been connected by a series of levels with it, as well as by containing the same quality of quartz and vein matter as is found in the Cariso.

I am informed that Mr. Roberts has just disposed of this property to the Wyoming Sweetwater Mining Company (Limited), of London, but at what price, and on what terms, I am unable to state. The Cariso will now be consolidated with the Irishman lode 1200 ft., now owned by this company, giving them a mining ground of 2200 lineal feet. Should the new owners work this property with the same energy as Mr. Roberts has heretofore done, the mines of Wyoming will demonstrate their value in the London market as elsewhere—not by mere report of what has been done and what can be done again, but by the strong and indisputable evidence of legitimate dividends.

The Cariso Mine has borne a searching examination from two of the best mining engineers of England, and has been very favourably reported on by both. With the opinion of such men, supported by the immense amount of quartz in sight, the Wyoming Company now have no doubt but that they will speedily realise a handsome return for their investment.

This company is now in possession of a 20-stamp mill, which it is proposed to erect at once near the mine. With this mill in full operation 30 tons of quartz can be reduced each day at an expense for mining and milling of $10 per ton. As it has always realised 3 ozs., or $60 per ton, it shows a profit of $50, or 10*l.* per ton. Reduce this, if you choose, by one-half, and then calculate upon the dividends realisable, and the results will demonstrate, as quoted by Ross Browne and Raymond, United States Commissioners of Mines, that "the Wyoming Gold Mines contain less base metal, and are the richest in pure native gold, of any in the known world." M.

WITH WHAT ARE THE STRATA ABOUT PRODUCTIVE LODES MINERALISED?

SIR,—Seeing several communications on this subject in the Journal, I was hoping for one by which some little light might have been thrown on the subject, but so far we are not much benefited by what has yet appeared. The differences of the elementary substances named by Capt. Williams and "Mining Engineer," as well as the component parts of minerals referred to, we can easily get from works obtainable at any time.

What we really want to know is—with what are the strata about productive lodes mineralised? I do not for one moment pretend to be able to analyse minerals, even so as to give an accurate account of their contents, and therefore to endeavour to analise the strata, so far as I am concerned, would be an absurdity. I would, however, make a suggestion, that those who are capable of doing so might, with advantage to themselves and the community generally, do so in such cases as the following. At the Logylas, or the Level Fawr, Mine (one of the Lisburne Mines) the Logylas lode contains only 3 ozs. of silver to the ton, whilst on a parallel lode, about 300 fms. south, the Glog Fach (another of the Lisburne mines) contains rather more than 30 ozs. to the ton. There is no apparent difference in the stratum, it being a compact clay-slate.

I will give another instance of which an analysis of the strata would be interesting. At Goginan the lead ore contains 30 ozs. of silver to the ton, and on the same vein, in the next mine, not quite 20 ozs. to the ton, and further eastward a much less quantity than 10 ozs, I know of the same vein of the Prince of Wales Mine, in Merionethshire, where the lode produces the same quantity of silver to the ton of lead, almost to 1 dwt., for miles in length.

I am inclined to believe, with "Mining Engineer," that the metals are not elements but compounds, and I have no doubt that this will be soon established as a fact. As to the term generally in use, that "the lode is in good strata for producing mineral," I may safely say in 90 cases out of 100 that these assertions are made more from the colour of the strata being identical with that of a rich neighbouring mine than its having the slightest allusion to the component parts of the strata.

I have merely placed these instances before those who may feel a sufficient interest to make such analyses as are here spoken of; and should anyone require any of the rocks referred to for such a purpose I should be only too happy to forward them to them, in the hopes of gleaning some information on a subject so immensely important to all connected with mining.

As this is written for the sake and with a hope of getting some useful information, and having no pretensions of being learned, but wishing to be learnt, I need not say I shall be pleased if someone capable of throwing a light on this matter will illumine our darkness.

Goginan, Aberystwith, Nov. 6. ABSALOM FRANCIS.

WITH WHAT ARE THE STRATA ABOUT PRODUCTIVE LODES MINERALISED?

SIR,—I have noticed in your Correspondence columns the question mooted as to the usefulness of having a systematic series of analyses made of the rocks adjoining ore-producing veins, so that some general law may, if possible, be established, by which the miner would be guided in forming an opinion as to the probable productiveness of a mineral vein in any locality. At present an examination of the appearance and position of the vein, and the nature and general character of the adjoining strata, afford by the aid of past experience the only means of forming a judgment on this point. There is no reason to suppose, however, that the fact of a rock having a peculiar physical character would, in itself, influence the deposition of metallic ores in the veins abounding in it; but rather would it seem to be simply an indication of the chemical composition of such rock on which the presence of the ore depends. The partial decomposition of such a rock as granite, which often augurs so favourably for metallic deposits, is simply the result of its peculiar chemical composition. The prevalence of certain metallic minerals in particular kinds of rock is well known, and if it can be shown that the presence of such minerals is due to the existence of one or more chemical elements in the rock then the advantage of analyses of the strata cannot be over-estimated.

Though we are aware that veins in a rock containing certain non-metallic minerals produce, as a rule, a given metallic ore, yet, so far as I know, this circumstance has not been satisfactorily explained. The presence of these non-metallic minerals, indeed, proves the existence of various chemical elements; for instance, granite consists mainly of three minerals—quartz (which is silica), felspar (a silicate of potash or soda and alumina), and mica (a silicate of alumina and potash). What is most noticeable here is the large proportion of alkali these minerals contain. We know that gold and tin (sulphuret) are soluble in alkalis; but I cannot show that these metals are found in granite (the most favourable ground for them) on account of this property, nor in consequence of the presence of potash or soda; but the fact of their occurring together is noteworthy. In the case of galena it is well known that limestones or clay-slates containing considerable quantities of lime are most favourable for its production; and it has often occurred to me that an analysis of clay-slates would be most desirable, as the proportion of lime contained in them would appear very materially to influence the quantity of lead ore found in the lode. A series of careful analyses would very possibly establish a connection between the occurrence of argentiferous galena and the existence of some particular chemical substance, as potash (in addition to the lime) in the adjoining rock. As for copper pyrites, it is difficult to say with what substance it is usually associated, except that magnesia would appear to be very abundant in the ground in which it occurs—as in greenstones, &c. Manganese occurs most abundantly near trappean rocks, through which it was probably disseminated at the time of their intrusion, being afterwards taken up in solution, and deposited in veins and fissures. Trappean rocks consist of silicates of lime, magnesia, potash, iron, and alumina; but there is no evidence to show that the preponderance of any of these is favourable to its occurrence.

We may advance various hypotheses to account for the appearance of particular metallic ores in rocks containing certain chemical matters. For instance, assuming that the minerals were minutely disseminated throughout the strata previously to the formation of the lodes, and being subsequently dissolved and circulated in the veins in a fluid state, a deposit of ore might take place owing to certain chemical substances having the property of precipitating it from solution on the sides of the vein. Thus, limestone might precipitate a solution of galena, in which case the occurrence of the two minerals together would be accounted for; or a mineral being held in solution by a certain substance might be deposited in a bed of rock, and afterwards on the formation of a vein it would be carried away and deposited therein. The existence, in the adjoining rock, of the substance in which the mineral was originally held in solution would serve as an indication of the presence of the metallic ore in the lode.

In forming an opinion of the prospects of a mineral vein being remunerative to mine, it is, of course, necessary to take into consideration the physical conditions under which it exists. However highly mineralised the adjoining strata may be, it is quite possible that, from mechanical causes, any chemical action was ineffectual, and the metallic ores were unable to find their way into the vein. On the other hand, a vein most promising to all external appearance may prove barren and unproductive on account of the unfavourable chemical constitution of the ground. My purpose in making these remarks is briefly to point out how desirable it may in time become to obain a knowledge of the chemical composition of the mineral ground before embarking in mining enterprises.

The mineralogist will be able to afford information as to the general composition of particular rocks in which he can distinguish minerals whose chemical constituents he knows; but to get accurate and precise knowledge it is necessary to resort to analysis, and it is only by a series of exact analyses and a careful record of the existing physical conditions that any general rule bearing on this subject can be established.—*Shifnal, Nov.* 1. A. H. MAURICE.

OUR HOME AND FOREIGN INVESTMENTS.

SIR,—Resuming my narrative from Sept. 9, I find that what was described as the products of the Nanty-Brain should read as the "Aberffwyd," in Cardiganshire. On reference to my note-book I see the yield from Nanty-Brain is much more favourable. I am, therefore, anxious to correct the error, and now furnish details:—

No. 1.—Lead.....	65·3 per cent.	Silver.....	32 ozs.	3 dwts.	12 grs.	per ton.
No. 2.— „	75·5 „	„	40	19	22	„
No. 3.— „	84·8 „	„	6	0	16	„
No. 4.— „	85·8 „	„	4	18	0	„
No. 5.— „	76·2 „	„	5	1	6	„
No. 6.— „	42·0 „	„	6	17	4	„

(The latter containing a trace of gold.)

Gossan ..... Silver..... 1 ozs. 12 dwts. 6 grs. per ton.

In my previous notes I quoted the results of the examination of the New Rosario, Mexico, for silver, showing a very high percentage —subsequently, by way of practice for my pupils, and satisfaction to myself, I have traversed the same ground again, and am able to confirm the original report, also to append the following as the *experimentum crusis* for the more noble metal:—

No. 1.—Gossan—gold	A trace.				
No. 2.— „	1 ozs.	12 dwts.	6 grs.	per ton.	
No. 3.— „	1	19	4	„	
No. 4.— „	1	6	3	„	
No. 5.— „	0	6	12	„	
No. 6.— „	5	14	8	„	
No. 8.— „	4	4	22	„	

It will be remembered that Nos. 3, 6, and 8 carried respectively 1704, 1955, and 1568 ozs. of silver per ton. Cornwall promises to repeat herself in auriferous and argentiferous wealth, particularly in the various gossans. In the sample I discovered upwards of 150 ozs., and in another 43 ozs. of silver, with gold to the extent of 1½ oz. per ton. This fact corroborates the thousand and one rumours that from time immemorial have obtained of boundless wealth being thrown away through carelessness, ignorance, or prejudice, and speaks volumes in favour of the prosecution of extensive researches, particularly into the chemical or metallurgical character of the gossans. It is clear that too little attention has hitherto been devoted to this subject, and, consequently, vast accumulations of debris rich in the noble metals have been, and are being, appropriated to the base purposes of road making and house building, while the most elementary acquaintance with assaying, judiciously applied, would rescue them from a fate so derogatory.

It strikes me forcibly that a scrupulous and frequent examination of the crust of the earth, the walls of the lode, or the associated rocks, would, in the long run, amply recoup the suppletory charge; and certainly there would be added to the stock of knowledge upon metalliferous surroundings a vast fund, at once deeply interesting and eminently instructive. The proprietary of the East Terras would appear to have obtained vantage ground, in the shape of further indication of hidden treasures. From them I have received a mass of ore, yielding 64·8 per cent. of pure tin. From a huge block of galena from the East Llangynog a fair average piece was broken off in my presence; this yielded 84 per cent. of lead, with but a small portion of silver. The former metal is exceedingly malleable, and may be pronounced fine Porter's lead. The assay shows the galena to be very solid, the associated gangue (carbonate of lime) existing in minute proportion. I regret very much to find the product of gold in one of the Irish properties quoted in your issue of the 4th inst. apparently falling off. I had anticipated better results. Perhaps, however, we must attribute this to one of two causes—either the samples were not from the immediate proximity, or, as it frequently happens, a film of gold occurred isolated upon one piece, and had no existence upon the other. In my cabinet is an illustration. Gold is there diffused over the surface where the specimen is fractured, and presents a brilliant auriferous appearance, yet a portion of the specimen from whence it was broken yielded only 12 dwts. of gold to the ton, whilst another, lying immediately upon the auriferous piece, gave upwards of 4 ozs. These are the incidents which try the patience and test the skill of the assayer, and demand his constant vigilance and personal attention. I regard this illustration as a beautiful and striking instance of its class. I am always glad to exhibit it to any persons interested in the subject, and shall be pleased to show it to any of your correspondents who will favour me with a call for that purpose.

Being now engaged in examining specimens of Irish bog, particularly in the matter of iron, I hope to be able to supply you with particulars next week. I may add that specimens of copper from an almost unexplored district in Ireland is yielding a large return in gold, but of this anon. W. WHITE.

Laboratory and Assay Office, 25, Finsbury-place, E.C., Nov. 8.

"THE SCIENCE OF INVESTMENTS"—CORNISH TIN MINING.

SIR,—The science of investments requires searching and earnest application and investigation of any and all subjects under consideration. The man of business should possess activity without bustle, dispatch without hurry, form without punctilio, order without rigidness, dexterity without craft, and vigilance without suspicion. Business never should overwhelm the student of the science of investments; and all these desiderata are essentially necessary—nay, indispensable—to the man who engages in mining adventure; yet probably, no medium for the employment of surplus capital is so fraught with vivid and lively excitement, and at the same time associated with gains, as that of Cornish tin mining, involving at the same time no keener or closer study than is observed by the man of business in the ordinary transaction of commerce and trade. It is the absence of these precautions that foster schemes and ephemeral concretions, whilst frequently *bona fide* and honourable enterprises languish for want of support.

The tin mines of Cornwall are a volume of self-support, in numerous cases employing thousands of the labouring classes, although the gains to shareholders may not be large, still in former years vast gains were acquired by the proprietaries, as, for instance, Great Wheal Vor, St. Ives Consols, Great Work, Boscaswell Downs, and other mines of similar calibre, yielding largely, employing many workmen, consuming quantities of material, and requiring extensive field-

of machinery. These mines are chiefly valuable to Cornwall, its merchants, and the executives of the companies. The future gains to shareholders of this description of property are highly problematical. It must be gratifying to all practically connected with mining to recognise the spring and vitality of such mines as South Crofty, South Condurrow, Pendarves Consols, North Levant, South Carn Brea, Wheal Uny, and West Basset. There are others equally deserving, though sadly neglected, and it is to such that we would direct the attention of the investing public.

Phœnix is the star of the East, and Tincroft of the West, whilst many a brilliant prize attest that the western peninsular of England yields metallic wealth at the present moment equally with any former epoch in the history of tin mining. It is rarely to be recorded in the annals of joint-stock companies that which we can say of tin mines conducted upon the Cost-book System—Carn Brea from 8*l.* has advanced to 150*l.*; Cook's Kitchen from 2*l.* to 36*l.* per share; West Basset, 10s. to 9*l.*; Dolcoath shares were sold some years ago at 8*l.* per 119th, the price is now 210*l.* per 1432d, and the dividends are 3*l.* 10s. two-monthly, the bottom of the workings is worth 120*l.* per fathom; Tincroft shares were sold at 3*l.* per 6000th, yet the price is now 61*l.*, and the dividends 42,000*l.* annually; South Crofty shares have advanced from 5*l.* to 36*l.* each; Botallack, 150*l.*, has advanced to 250*l.*; Kitty (Lelant), 2*l.* to 8*l.*; Margaret, 30s. to 18*l.*; South Condurrow, 2*l.* to 9*l.*; North Levant, 2*l.* to 16*l.*; North Roskear, 2*l.* to 23*l.*; South Frances, 18*l.* to 57*l.* South Carn Brea, Wheal Uny, West Frances, Buller, Wheal Grenville, Ding Dong, and Spearne Moor are equally influenced through the advanced price of tin, and the revival of confidence in tin mining. We may further add that there is room for yet increased market value of many a mine in Cornwall, and especially so when we compare quotations with those of popular favourites, which daily attract undue attention upon our exchanges. Why should Van sell for 800,000*l.* and Tincroft at 340,000*l.*? Tankerville at 216,000*l.* and Dolcoath only at 300,000*l.*? Grenville actually sells at 46,000*l.*, against Botallack, 50,000*l.*; Providence, 28,000*l.*; North Levant, 30,000*l.*; West Frances, 53,000*l.*; and Kitty (St, Agnes), 55,000*l.* It is not, however, our province to scrutinise too closely, far less severely, the affairs of or the motives and interests of shareholders and jobbers; suffice it for our present purpose to point at those mines which we have from time to time advocated through your valuable columns, and it is gratifying to add that they now constitute the substantial prizes we possess. Still there are others to which we could refer that are all but totally neglected, yet those are the undertakings that enrich the investor, and render mining both the most lucrative and fascinating medium for the employment of spare capital.

There are two or three tin mines that are about being introduced to the public under favourable auspices, and to all *bona fide* investors I shall be pleased to forward information upon application. It should be remembered that mining is one thing and share jobbing another. Most of the valuable mines in Cornwall are conducted upon the Cost-book System—Dolcoath, Tincroft, and such like properties are free from the taint of speculative executives; the works are practically and economically managed, and vast is the wealth that such undertakings contribute to the nation, enriching the enterprising, finding employment to a wide circle of industrious workmen, and benefiting merchants and shopkeepers through the expenditure of large sums of money raised from the bowels of the earth.

R. TREDINNICK,
Consulting Mining Engineer.

Crown Chambers, Threadneedle-street, London, Nov. 6.

CALIFORNIAN MINING ENTERPRISE.

SIR,—I am instructed by the President of the Mining Bureau to address you in regard to a misapprehension which has apparently arisen concerning the objects of this institution. The withdrawal from the market of the Independence Gold Mining Company of California has been commented upon by certain journals in a way to show that they supposed the Bureau to be an agency for the sale of mines. It is the desire of the Board that this mistake should be promptly rectified. The mining Bureau was organised for the purpose of protecting the interests of the *bona fide* minowners, and of affording foreign investors some guarantee for the genuineness of the mines placed on the market, as well as securing to shareholders an assurance of such reasonable profits as have not always accrued to those whose investments were manipulated by professional projectors of companies under the old system. The Bureau does not, however, undertake to appraise the value of mining property, nor are its reports to be regarded as indicating more than the fact that such and such mines are genuine, and not mere "wild cat" schemes. It proposes to guard foreign investors to the best of its ability from the dishonest machinations of mining sharpers, but it is not in a position to declare what value should be placed upon any mining property which may be purchased upon the Pacific Coast by foreign agents and subsequently placed upon the London market. If the Bureau is desired to furnish a report upon a given mine it will do so, speaking, however, only to the genuineness, general character, condition of development, grade of ore, and surroundings of the property examined. If such a mine be purchased in California for (say) 40,000*l.*, and subsequently placed on the London market at 100,000*l.*, the Bureau is in no sense responsible for a line of action its managers not only dissent from, but which they must regard as opposed to the interests alike of English capitalists and shareholders and Pacific Coast mine owners. The fact, however, that such things are attempted should be accepted as a proof of the need that existed for such an institution as the "Mining Bureau." Opposition to this very system of grasping middlemen constitutes one of the primary purposes of its organisation, and the withdrawal of the Independence Mine is really an illustration of its healthful influence, inasmuch as this case has shown that the old dishonest plan can no longer be pursued with safety. In conclusion, allow me to repeat that the Bureau does not trade in mines; that its reports are unprejudiced and without favour, and that no man or corporation has any right to use its name in any other way than as guaranteeing the genuineness of the property it endorses. These facts should be distinctly borne in mind, for unless the true position and purposes of the Mining Bureau are understood by the public there is danger that unscrupulous speculators may seek to avail themselves of its limited endorsement to convey the idea that certain mines are placed on the market under its auspices.

Sacramento, Oct. 14. GEORGE F. PARSONS,
Corresponding Secretary, Mining Bureau.

CEFN CONSOLS MINING COMPANY.

SIR,—Knowing that the *Mining Journal* is the only proper channel through which information can be obtained when the directors of public companies (of course, I mean mining companies) will not give information, I address myself through your columns to my brother shareholders in Cefn Consols, and I ask them whether it is right that we should have meeting after meeting adjourned, in order to suit the convenience of directors? At the end of this month the adjourned meeting is to be held, and then we are to hear of something "good:" but I should not be surprised if the meeting were still further adjourned. It is, I believe, correct that the directors hold nearly two-thirds of the shares, but that is not sufficient reason for not conducting the workings with spirit, and energetically working the mine.

It is well known that the lead ore is in abundance at Cefn Consols Mine, but we require men at the head of affairs to see that the agent does his work thoroughly. The mine has not yet been properly managed, or we should have had some results. I would ask how is it that no report ever appears in the *Mining Journal*? I hope to attend the next meeting, whenever it is held, and shall certainly propose a committee of investigation unless something satisfactory is forthcoming before the meeting. Several other shareholders will support me.

Nov. 8. AN ORIGINAL SHAREHOLDER.

FLORIDA MINE.

SIR,—As a holder of shares in this mine I wish, by means of your influential Journal, to call attention to the fact that the shares are never "quoted" or "dealt in" on the Stock Exchange. Now, why is this? The directors of the Florida Mining Company (Limited) have a very high opinion, I know, of the property, and the prospects are as good as can be wished, but yet no dealings are ever recorded in the shares. If the mine is as *bona fide* an adventure as we have been led to believe, then I think the shares should be quoted.

A SHAREHOLDER.

THE POLBREEN MINING COMPANY.

SIR,—I am a holder of shares in the Polbreen Tin Mine, and have been waiting month after month—I suppose like many others—for a realisation of the grand results which Mr. Y. Christian has continually assured us were within grasp. Now, I do not for one moment expect Mr. Christian, or any other member of the committee—of which he forms one—to be infallible, but surely the very wide discrepancies in recently published reports respecting the property justify me in asking, through your valuable Journal, that the shareholders (other than the select few who meet at the mine on account days) may be furnished with some explanatory statement which will enable them to see somewhat clearer how their prospects really stand.

On Dec. 21, 1870, Mr. Christian in his "Financial Gazette" stated in a most assuring manner that without a doubt at the next account day in February or March, 1871, the main business would be to take into consideration the time and amount of the first dividend. Nine months have gone by, and how has this tempting promise been fulfilled? Why, at the present moment I have before me an intimation from the secretary to the effect that the mine is so heavily in debt that a call of 15s. per share is necessary to liquidate it.

At the meeting in July the property was in debt 628*l.*, but we were cheered by the assurance that 9 tons of tin were already broken, and would more than clear the debt. Now at the meeting last week the debt has reached between 1400*l.* and 1500*l.*, and no tin appears in hand to balance it. I observe, further, that (leaving out the 9 tons on hand in July) all the tin the mine has been able to send to market in the four months, July to October, is 3 tons 14 cwts., realising about 300*l.*, while the working expenses and cost of materials amounted to 1868*l.*, and yet we repeatedly hear that the mine is producing 400*l.* worth of tin per month. I need not say more; these facts speak loudly for themselves, if a satisfactory explanation can be furnished I for one shall be glad, but if the matter is allowed to remain unseen to, the adventurers must not be surprised to find shares in their property not only unmarketable, but in the hands of brokers for sale at any figure they will fetch. DISAPPOINTMENT.

CHIVERTON MOOR, AND ITS MANAGEMENT.

SIR,—As the meeting of shareholders of the Chiverton Moor Mine will shortly be held, I trust that as many as can make it convenient will make a point of attending. There seems to be a great feeling of dissatisfaction at its management, and that through this mismanagement a valuable property is being sacrificed. The exceeding want of confidence is shown in the depreciation of the shares, and the letters which from time to time are being written in the *Mining Journal* about it. One writer alludes to that unfortunate company Wheal Luddcott and Wrey, but I trust that none of our managing body were at all connected with that concern, which brought so much discredit upon mining adventure. Finally, I would say let us come to the determination either to place our mine in such a position as will give it the public confidence that it is being worked for the advantage of the shareholders, or let us wind it up, and make the most of our property before we have incurred further loss.

DISAPPOINTED SHAREHOLDER.

[For remainder of Original Correspondence see to-day's Journal.]

NEVADA, AND ITS MINES.

All interested in the mines of this famous State will peruse with interest the statement made by the Hon. Mr. KENDALL, at the meeting of the East Sheboygan Company, the details of which appeared in last week's Journal. Mr. Kendall is a member of the United States Congress; and the greater value attaches to his statement by reason of his long and intimate connection with the State.

The Nevada mines (says Mr. Kendall) rich as they are, profitable as I know them to be, will not bear an unlimited issue of stock, based upon an assumed capital so monsterously disproportionate as we have in some instances seen. There is a reasonable medium in all these things; and it might be well to enquire whether or not some manifestations of disappointment may not emanate from those who have imprudently invested their means in mines, good indeed, but the profits of which are divided and subdivided to a most unreasonable extent by an absurd over issue of stock, based upon rare and exceptional yields from those mines. Let me speak briefly of the general character of the mineral belt, including the American "Great Basin," within which was the State of Nevada. This great mineral belt, or zone, really commences near the city of Cajaca, in Southern Mexico, and rapidly spreads out, like a fan, towards the north, until at about the 40 parallel of latitude it has attained its greatest breadth of not less than 1200 miles from east to west. Thence it becomes narrower and narrower, until it is lost in the wilds of Aluska.

No other mining region can compare with this, either in its vast productions or extent of area. Its present yield, including British Columbia and Mexico, is from $90,000,000 to $100,000,000 annually. And, although its production of gold is slightly decreasing, its production of silver is more rapidly increasing. Mining has been carried on in the Mexican portion of this belt for the last 300 years, and the mines are not exhausted. On the contrary, the annual product has gradually increased from the beginning of the present century up to the year 1856, Since then the unsettled condition of the Government over the country may have caused a slight falling off in the yield. Thus we find that the southern portion of this great mineral region has not been exhausted by three centuries of mining. On the contrary, its only rival in productiveness has been that portion of the same belt lying to the north, and within the United States. Let me now call your attention to that portion of the belt or zone lying within the State of Nevada—included, as I have said, within the great interior basin of the North American continent. This basin is, in reality, an elevated plateau, of an altitude above the sea level of from 3000 to 4000 ft., and is traversed by mountain ranges, running generally north and south, which rise to a still greater height above the surrounding country of 3000 to 5000 ft. The outlying barriers, or "vein," so to speak, of this great elevated plateau and basin are the Rocky Mountains, including the Wasach range, on the east, the Wincl River Mountains on the north, and the Sierra Nevada Mountains on the west. On the south-west this vein seems to have been broken down and swept away, forming an opening out into the Colorado Valley and the Gulf of California, through which, doubtless, was drained the great inland sea that at some remote age washed the surrounding mountain range as its shores. Such is the opinion of the best scientific authorities, and is evidenced, among many other things, by the presence of marine shells, found in abundance all over the region mentioned.

The first discovery of silver mines in Nevada, in this portion of the great mineral belt, was in 1859, and upon what is known as the Comstock lode, in the western part of the State. This was the first discovery of any important silver-bearing lode in the United States. Prior to this time it was not known that the vast plateau, which I have briefly described, lying between the Rocky Mountains and the Sierra Nevada contained any of the precious metals. But now it is a well-established fact that this whole region is quite as rich in those metals, besides being more extensive, as the corresponding section of this mineral belt in Mexico. Let me call your attention to the working and the product of some of the mines upon this great lode, and then judge for yourselves whether or not mining in Nevada may be a profitable business. My statements are taken from reports and data furnished by agents and superintendents of mining companies to the United States Commissioner of Mining Statistics, acting under authority of the Federal Government. In ten years from its first discovery and working the Comstock lode has produced $120,000,000, and has paid $30,000,000 in dividends. To be more specific, consider what has been done by a few of the companies engaged in working this lode and the cost and profits of the same. Notice the Savage Company, for instance—the cost of mining, production, value of ores, and net returns:—

Years.	Mining.	Milling.	Total.	Yield.	Profit.
1866-1867	$7·91	$14·04	$21·95	$41·94	$19·99
1867-1868	7·21	13·74	20·95	40·84	19·89
1868-1869	8·90	12·22	21·12	34·87	13·75

From the date of the organisation of the company the amount of ore extracted has been 339,808 tons; gross receipts from bullion and from ore sold, $13,304,740; assessment levied, $118,000; and dividends disbursed, $4,528,000. Again, the Kentuck Mine, for the year 1869, declared two dividends, amounting to $100,000; and for the previous year the following statement of the working is made:—The amount of ore raised, 31,390 tons; gross yield, $1,257,563·85; net yield, $515,043·13; yield per ton, $40·06.—Cost of production and reduction, $23·65: net profit per ton, $16·41. During the same year the Crown Point Mining Company declared dividends to stockholders to the amount of $36,000; and the ore statement for that year shows that 25,832½ tons were reduced, yielding $845,627, or an average of 32·73 per ton. The cost of mining and milling the ore amounted to $21·46 per ton, leaving a net profit of $11·27 per ton. If I did not feel that I might be trespassing upon your courtesy, I might go on and mention other companies working on this circle that have shown equally good results. But so much, in brief, for the western part of the State, and the mines first discovered.

A word in regard to Eastern Nevada and mines of more recent discovery. In this part of the State is my own home, and here are your properties, with one of which, as I have said, I have some acquaintance. The first discovery of silver mines in this portion of the State was made in 1863, near the site of the town of Austin. Afterwards a tribe of eager explorers, like a refluent wave, from California and Western Nevada, pressed back more and more to the east into still new and unprospected regions. The rich deposits—White Pine Mountain, Treasure Hill, Eureka, and last, Meadow Valley, on the confine of the State—were discovered. The Eureka mining district, first effectively opened in 1869, will give a bullion yield for the present year of $3,500,000; and Meadow Valley will produce $4,000,000; and the whole product of Eastern Nevada for the year 1871 will not fall short of $11,000,000, against $5,000,000 in 1870. The whole product of the State for the current year will be about $21,000,000. And as a significant fact touching mining operations in the Pacific States and Territories, we find from Wheeler's Stock Report that the mines represented in the San Francisco Stock Exchange have levied assessments up to the month of April last amounting to $11,328,517, while the same mines have up to the same date paid dividends to the amount of $22,837,849, and according to late quotations the market value of these mines is $24,316,731, and the dividends paid for the month of September, 1871, amounted to $322,400, or a monthly interest of 1⅓ per cent. on the market value of the stock, and 2⅔ per cent. monthly on the amounts collected.

The product of some of the Eastern Nevada Mines is so notably large that I notice them briefly. The Eureka Consolidated, Eureka district, yields an average of $6000 per day, at an actual expense of less than $1000 per day; and the Raymond and Ely, Meadow Valley district, between $6000 and $7000, with one 20-stamp mill, or at the rate of $2,000,000 in round numbers per annum, and four-fifths of that amount is profit. And, further, in regard to the net profits of silver mining in Nevada, let us compare them with the profits realised from some of the principal silver mines of Germany. From the Freyburg Mines the profits, ranging through a period of many years, have never reached more than one-fifth of the value of the silver produced, and they have often ranged as low as from one-eighth to even one-twentieth. The Himmelfürst—the workings of which are on several veins—has been the most productive. In this, omitting fractions, the ratio of profit to the total amount of silver produced has been:—

Periods.	Profit.	Total silver.
From 1624 to 1830	as 1	to 7
,, 1748 to 1850	,, 1	,, 8
,, 1769 to 1831	,, 1	,, 6
,, 1530 to 1629	,, 1	,, 5
,, 1710 to 1763	,, 1	,, 10
,, 1764 to 1850	,, 1	,, 20

But I fear I have too far occupied your time. Permit me, Mr. Chairman and gentlemen, in conclusion, to express to you my gratification at this pleasant first introduction to a land and a city whose thronging historic associations have followed civilisation in course—filling the day-dreams of youth, and nourishing wisdom and heroism in maturer years.

In paying homage, as I do, to the older institution and culture, I know that I represent the sentiments of a people to whom, and to the trust they have honoured me with, my friend has kindly referred. While our people, shaping from a wilderness the foundations of a fair and noble commonwealth, are justly proud of their bold energy and enterprise, they are not vain and conceited boasters, claiming, according to the traditional notion, superiority in all things. No; we understand full well that new institutions and new societies are necessarily imperfect; that men engaged in a hand-to-hand struggle with the elements and with savage tribes, have little leisure to gather around them the embellishments of life. Little time, indeed, have we, but the inclination, the ardent desire, and willing mind, ever eager for instruction, exultant in the possession of vast resources undeveloped, and in capacities for the highest attainments.

In all that marvellous country, seamed through and through with mineral and metallic veins exhaustless for centuries, you may see the evidences of what I say. Enter the rudest cabin of the prospector who has pushed far into the wilderness, or explored a new range of mountains, and founded his little settlement, and you shall find in his rough apartment, among the newspapers of the day, works of Macaulay, Thackeray, Dickens, Tennyson, Mill, Tyndall, and Faraday. Questions that absorb your attention here—the Army Bill and Church Disestablishment—are discussed there, though, of course, crudely and imperfectly. A state larger in area than the whole United Kingdom, but smaller in population than the county of Kent, so abounding in resources newly discovered, which are owned and possessed by men of limited means, naturally looks to older communities and business circles, where capital is abundant, and is seeking investment content with moderate return. The interests, therefore, of the farthest West, from which I come, thanking you for this cordial welcome, are correlated to your own that which is wanting to us, you may supply, and, so supplying, receive most ample reward to yourselves.

HEMATITE ORES, AND THE IRON TRADE.

At no period of its history has iron commanded such marked attention as now. This country, rich to a fabulous extent in iron ores of almost every description, stands foremost among the iron producing countries of the world.

The steady and continued endurance of her mining population is a power for good that can scarcely be over-estimated, and the spirited enterprise of our capitalists having raised us coal, has made also for us iron, by means of which almost everything else appears to be moved, It is the fulcrum of England's greatness, and with it all the intricate ramifications of her varied industries are as it were welded. No wonder then that capitalists have made colossal fortunes by the daring of their enterprise, and that the whole world should look to England as the guarantor of iron. Her "special brands" are everywhere taken on good faith, and this prestige once obtained has been ever since held intact. Notwithstanding all this, it may be a matter of surprise to some of our friends that the present supply of iron is not equal to the demand, and that large orders for forward delivery are by some of our principal ironmasters either indefinitely postponed or altogether declined. But so it is, and it is a fact of a very encouraging character in this important branch of industry that the present appliances are not sufficient to provide for the increasing demand. One of the reasons assigned for this is the change of constituents in a few of the long-esteemed ironstone beds—that is to say, amongst hematite ores—whether for Bessemer steel or other purposes. A good deal of the misgiving on this head is, perhaps, more imaginary than real, and it may be that a grain of truth has grown to a pound of exaggeration; but, certainly, the ghost of distrust keeps flitting before the vision of the more matter-of-fact consumers, and they have become anxious about the supply for the future.

Treating the subject of deterioration slightly, it is evident, whatever some interested people may say, some of the old sources are nearly worked out, or their yield comes to market at times in such questionable shapes as to create alarm. What, then, can be done? Our sources of ironstone are practically inexhaustible, or, in any case, equal to our available weight of coal to smelt it. New sources, therefore, must be opened up, and the general public, who for the most part have been shut out of this class of investment, are beginning to have a desire to possess a co-operative interest in their well-doing. Indeed, so much has the value of iron ores, particularly of hematites, increased in the last two years, that it is no longer possible to be blind to such an agreeable fact. Few people have heretofore taken the trouble to realise the importance of an iron rail. A railroad is a wondrous medium of interchange; the peoples of the globe are being fast banded together by the drawn out rails; and humanity has learned, and continues hourly to learn, how to multiply its life by creating opportunities in time. The more enduring steel, however, now offers itself as an economic substitute for iron rails. Mr. Bessemer has made steel cheaper in the end than iron, and has reaped his well-earned reward. The demand for Bessemer steel has of late caused such a pressure upon its manufacturers that it has literally become a struggle to obtain the class of hematites altogether appropriate. The demand, moreover, is never likely to be less, but it necessarily must be more; the struggle, therefore, for the suitable raw material must in consequence increase. There is one obvious remedy, and that is the searching for and opening up new sources of supply. And when so much spare capital is lying idle and waiting for utilisation, it is not in the nature of things that its keen owners should overlook the present settled prosperous condition of the iron trade, or to watch uninterested its enormous expansiveness.

A glance at the statistics of the manufacture of pig-iron for 1869 (no later returns are as yet published) will interest those whose thoughts have not been led in that direction. In that year there were 600 iron furnaces in blast in Great Britain. The weight of iron ores smelted was 11,639,845 tons, and valued at 3,732,560*l.* The total production of pig-iron was 5,445,757 tons, and valued at 13,614,397*l.* This grand total was, in 1870, largely increased, and still further augmented in the pre-ent year.

These are really astonishing facts, and when viewed in connection with the thousands of busy industries set in motion by it, the great importance of encouraging its production becomes apparent. Enhanced in value by its manufacture, our exports have become enormous, and with such facts before our eyes, we are not at all surprised at the impetus recently given to ironstone mining.

In the necessity for obtaining ores of a superior character and of extended amount, attention has recently been attracted to the wonderful deposits of hematite and apathose ores in the North of Spain. Here whole mountains are composed of the most valuable and richest ores, and here an industry will speedily be developed, which for extent and profitable character will completely cast in the shade all existing supplies. But this profit and the advantage of this working will depend on questions of situation, accessibility and ease of shipment, which will be paramount. The subject has our attention, and we shall take an early opportunity of recurring to it.—*Chadwicks' Investment Circular.*

THE TREFFRY LEAD SMELTING WORKS, PAR.

A CORNISH PERU.

Nearly midway on the Cornwall Railway, between Plymouth and Penzance, lies the bustling harbour of Par—the creation of one who was perhaps the greatest business genius that the county of Cornwall ever produced—the late Mr. Joseph Thomas Treffry (formerly Austen), of Place Fowey.

Indirectly, Par owes its origin to the famous Fowey Consols Mine, now abandoned, but once so rich that it returned more than 130,000*l.* profit to Mr. Treffry alone; and it is the locality of the Cornish Peru, the Treffry Lead Smelting Works, the only ones in Cornwall, where silver is yearly produced by the ton.

The outward and visible sign of these smelting works is the giant chimney stack heretofore noted, which towers to the height of 235 feet, contains something like a million and a quarter of bricks (made upon the spot out of Par mud), and is connected with the furnaces by a horizontal flue 600 yards in length. There is nothing particularly promising in the look of the lead ore as it lies in the yard in heaps waiting for the smelter. It looks more like a fine dirty gravel than anything else. The first process which it undergoes is that of roasting. This simply consists in heating it in a reverberatory furnace to drive away the sulphur and arsenic that may be present. Roasting over, it is put into another reverberatory furnace—known as the flowing furnace—with a flux of lime and culm, and is reduced to the metallic state. When it is melted the furnace is tapped, and the lead allowed to run into an iron pot, whence it is ladled out into iron moulds.

And here the peculiarly interesting part of the smelting begins. It is a characteristic of lead that the most of its ores contain silver. These of Cornwall invariably do. The problem before the smelter is the extraction of that silver with as little waste of lead and at as low a cost as possible. Sometimes the quantity of silver is so small as not to be worth taking out—this is easily determined by assay—but the quantities that do repay extraction are very much smaller than the uninitiated would believe. Lead ore which contains 50 or 60 ounces of silver to the ton is rich above the average. The first part of the process of desilverisation was formerly conducted at Par upon the Pattinson or crystallisation system. It is now carried out upon the patent method devised by Flach, a German metallurgist, which was first introduced into England at Par, but has since been adopted, on the faith of the experience gained there, by some of the largest lead-smelting firms in the kingdom. The crystallisation process is easily explained. The object of desilverisation in its first stages is simply to effect such a separation between the silver and the lead as will leave the former metal in union with a much smaller proportion of its base alloy, and thus better fit it for the refiner. This used to be effected at Par in the following way. There was a range of eleven iron pots, each capable of holding 10 tons of metal. Into the central one of these the rough lead was put, and brought to a state of fusion. Lead is easily crystallisable, whilst silver is not, and this fact formed the basis of the subsequent operations. The lead as it crystallised was ladled into a pot on the one hand, whilst the non-crystallising residuum, in which the silver was of course present in a more concentrated form, was ladled into a pot on the other. Through pot after pot the process was repeated, with practical details of manipulation which here are unimportant, until at length the smelter had at one end of his pot range a pot containing lead in which the quantity of silver had been reduced to a minimum, and at the other end a pot of metal in which the silver was present in the proportion of 500 to 600 ounces to the ton, and which went thence to the refiner.

Flach's method differs from this in every particular, and is a beautiful adaptation of a law of chemical affinity. Silver has a greater affinity for zinc than for lead, and if zinc be present and the silver is free to act will attach itself to it. The basis of Flach's process is, therefore, simply the adding of a certain proportion of zinc to the molten lead. This done the whole is kept well stirred, when the zinc, being lighter than the lead, rises to the surface, bringing the silver with it, and is skimmed off and thrown into a smaller pot adjoining. Here the process of heating and skimming is repeated, the skimmings passing thence to a third pot, where they are similarly treated; for it must not be imagined that it is possible to conduct the operation so delicately as not to take up in each skimming far more lead than either zinc or silver. The final result is a very rich alloy of lead, zinc, and silver; and the next business is to get rid of the zinc. It has been a good servant; it has done its work, and therefore (which would be a *non sequitur* in human affairs) it is to be discharged. This is effected by heating the alloy with coke and iron slag in a blast-furnace, by which the zinc is volatilised, and there is left for the refiner a mass of lead and silver, in which the latter metal is present in the proportion of 1300 to 1500 oz. to the ton.

And now comes cupellation. The cupel is a shallow elliptical vessel made of burnt bones in an iron frame. In this richly argentiferous lead is exposed in a melted state to a current of air, which oxidises the lead, converting it into litharge. This, with all other impurities, floats upon the surface of the silver, and is skimmed off as it rises; the process being continued with the addition of fresh lead, until the cupel is full of the more precious metal, when the silver is run off through holes in the bottom of the cupel into ingots. The produce of each cupel is called a cake, from the fact that the silver formerly used to be turned out of the cupel in one massive block, when it had to be cut up with chisels,

Cakes of this kind have been produced at Par exceeding 13,000 ounces in weight, and worth between 3000*l.* and 4000*l.* The average weight is 11,000 or 12,000 ozs. Surely we are right, then, in calling such an establishment as the Treffry Smelting Works the Cornish Peru.

The litharge is brought back to the metallic state in a furnace, the loss of lead in the operation of desilverisation being about 2¼ per cent. The lead from the first of the Flach melting pots is run off from the bottom of the pot, and remelted in a reverberatory furnace to get rid of the zinc, the resulting metal being remarkably pure. We should add that such parts of the slag from the various meltings as contain either lead or silver in appreciable quantities are worked over again, and that some which contains copper, and is therefore separated from the rest, is sold to the copper smelters for the extraction of that metal.

The advantages of the Flach over the Pattinson process are very marked. The zinc, of course, is wasted; but whilst under crystallisation eleven 10-ton pots and 14 men were employed to desilver and render marketable 39 tons of lead weekly; under the new system one 10-ton pot, two smaller ones, and a calcining furnace with eight men will desilver and render marketable 70 tons. Besides, there are only 7 or 8 tons to cupel against 20 or 30.—*Western Morning News.*

VOLUMETRIC ANALYSIS.

Although this system of analysis has received far less general recognition in this country than in Germany and France, its importance in connection with technology is unquestionable; it is, therefore, particularly gratifying to find that a second edition of Mr. SUTTON's very valuable volume* on the subject has become necessary. With the exception of this book, and the translation, or, rather, adaptation, of "Bolley's Manual of Technical Analysis," by Dr. B. H. Paul (issued in Bohn's series), there has been positively nothing published in England that could with any confidence be referred to either by the student or man of business; and hence it is that the old system of roughly guessing as a rule, and sending to the assayer as an exception, has been continued. Upon the issue of the first edition of the book now under consideration we noticed the thoroughly practical arrangement of the information given; that arrangement has been retained, but the book has been enlarged and revised, so as to include all the principal methods which have been introduced up to the present time.

Referring to the general principles of this system of analysis, Mr. Sutton remarks that the operations involved in gravimetric analysis are frequently very complicated, and occupy a long time, besides requiring in many cases elaborate apparatus, and the exercise of much care and experimental knowledge. Volumetric processes, on the other hand, are as a rule quickly performed; in most cases are susceptible of extreme accuracy, and need much simpler apparatus. The leading principle of the method consists in submitting the substance to be estimated to certain characteristic reactions, employing for such reactions solutions of known strength, and, from the volume of solution necessary for the production of such reaction, determining the weight of the substance to be estimated by the aid of the known laws of chemical equivalence. For technical purposes, such as the examination of substances used in arts and manufactures, the system has been a great boon, and every day is bringing fresh applications of it both to pure and applied chemical science. The only condition on which the volumetric system of analysis can be carried on successfully is that the greatest care is exercised with respect to the graduation of the measuring instruments, and the strength and purity of the standard solutions. A very slight error in the analytical process becomes considerably magnified when calculated for pounds, hundredweights, or tons of the substance tested. The end of the operation in this method of analysis is in all cases made apparent to the eye. In alkalimetry it is the change of colour produced in litmus, turmeric, or other sensitive vegetable colouring matter; the formation of a permanent precipitate, as in the estimation of cyanogen; a precipitate ceasing to form, as in chlorine and silver determinations; the appearance of a distinct colour, as in iron analysis by permanganate solution, and so on.

In the present volume several important improvements have been introduced, such, for example, as the adoption of the modern system of atomic weights, and the chapter on instruments and apparatus has been much enlarged. In referring to analysis by saturation, the value of cochineal solution instead of litmus is pointed out; it is less modified in colour by the presence of carbonic acid, and not so readily affected by weak organic acids as litmus. Again, the Mansfeldt process has been described amongst the methods of titrating copper, and many other additions and corrections might be mentioned; but it will suffice to say that the information has been brought down to the moment of publication, and Mr. Sutton has carefully borne in mind that "volumetric analysis has had an abundant crop of weeds and rubbish, together with, here and there, sound fruit," and he has evidently used every effort that with this sound fruit his readers shall be well supplied.

* "A Systematic Handbook of Volumetric Analysis, or the Quantitative Estimation of Chemical Substances by Measure, applied to Liquids, Solids, and Gases." By FRANCIS SUTTON, F.C.S.—London: J. and A. Churchill, New Burlington-street.

THE MINERALOGY OF CORNWALL AND DEVON.

That the advancement of knowledge is materially aided by the collection of all the facts connected with a particular district has been so generally admitted that it will be scarcely necessary to observe that Mr. Collins's volume* is calculated to be of considerable value. He tells us that the handbook is the product of a few hours of brief leisure of a busy life, and that it is intended primarily as a work of reference to the student, the mine agent, and the working miner; for this reason he has arranged the book precisely in the manner in which it is most likely to be of practical utility in connection with the mines. Mr. Collins remarks that the student having obtained a new specimen is naturally desirous to know what its properties are; he will then desire to determine whether any similar mineral has been described before; next, he will wish to know how to arrange it with his other specimens, as well as where it has occurred before; and, finally, he will endeavour to ascertain the conditions of its occurrence. To afford the necessary information upon these points he divides his book into five sections, treating of determinative, descriptive, systematic, distributive, and paragenetic mineralogy respectively.

In the section devoted to determinative mineralogy Mr. Collins carefully explains the order in which the observations should be made in order systematically to ascertain the form, physical characters, optical characters, chemical characters, and blowpipe re-actions; and he gives excellent tables for reactions in matrass, in the open tube, on charcoal without fluxes, with cobalt solution, on charcoal with fluxes, with the borax bead, with microcosmic salt, by coloration of the flame, and with solvents. These are followed by a table especially applicable to the countries particularly referred to in the volume, showing the minerals of Cornwall and Devon arranged in groups for convenience of identification. In this last-named table the name of the mineral is first given, and in the succeeding columns its colour, behaviour on charcoal, in borax bead, and solubility are stated, the last column being reserved for miscellaneous remarks. In the case of minerals soluble in water he gives the taste and the special experiments for distinguishing them, and, where necessary, the streak, hardness, and specific gravity. In referring to descriptive mineralogy he gives a copious list of the nomenclature of minerals occurring in Cornwall and Devon.

With regard to systematic mineralogy, the widely different views entertained has led to the proposition of many different methods of classification, and as four, at least, of these are in almost equal favour, Mr. Collins has wisely given all—the chemical, and undoubtedly the best, system in use at the British Museum; the economical system in use at the Museum of Practical Geology in Jermyn-street; the mixed system of Weiss and Nicol; and arrangement according to crystalline form, which has also very much to recommend it. The next chapter of the first part, which treats of distributive mineralogy, gives the names of the several parishes carefully arranged in districts; whilst in the succeeding columns the locality, the produce of the mines, and the more remarkable minerals found in them, are carefully stated. The remaining chapter, on paragenetic mineralogy, is very general, but gives the leading examples of paragenesis recognised by Cornish miners. The second part of the volume comprises a mineralogical dictionary for the two counties, the details for which have been culled from the best authorities obtainable.

The book has received extensive patronage from subscribers, and its utility to those interested in the mineralogy of Cornwall and Devon cannot be questioned; so that it may be anticipated that it will be equally well received now that it has been issued to the public. To whatever part of the volume we turn we find evidence of immense labour and research, and from the careful manner in which the whole is arranged the information given can be readily referred to. The value of the book is much enhanced by the admirably executed plates of crystallographic forms which are given, so that for those for whom the work is intended there is little to be desired.

* "A Handbook to the Mineralogy of Cornwall and Devon, with Instructions for their Discrimination, and Copious Tables of Localities." By J. H. COLLINS, F.G.S., &c. Truro: Heard and Sons. London: Longmans.

USEFUL HINTS TO INVESTORS.—Mr. F. W. MANSELL, in his recently-issued pamphlet, entitled "What to Select—What to Avoid," says—"In these days of mythical conceptions, placed before the public in attractive guise, with a shadowy future of golden prosperity, never to be realised, it behoves the investor to be watchful over his own interests, and (under experienced guidance) know what to select and what to avoid. There are mines and mines, and to select the one and eschew the other can only be done by those who, from a long and practical experience, have become familiarised not only with the character of the respective mines, but (which is of equal importance) also the *status* of the executive and management entrusted with their development. It is not the purpose of this pamphlet to embody all mines deserving the attention of the investor, nor to indicate those which should be spurned; but rather to point out a few *bona fide* properties of proved value and inherent merits, justifying the market value of the shares. Mining is an enterprise admittedly speculative—in other words, mining is capable of yielding enormous profits by the judicious expenditure of a comparatively small amount of capital. For this reason caution, guided by honest and matured counsel, is an indispensable essential in the successful selection of really good mines. Nothing is easier than to effect purchases—nothing more difficult than to select that which shall result in profit and reject that which shall incur loss. Ordinary caution is of but little avail, nor will unusual caution avert in every case unremunerative results; but whether as a speculator or an investor, profits—and large profits—are to be made if mines are properly selected, and at the proper time. The shares in a mine may be worth buying to-day—that is, before any great advance in market value has taken place, but it requires much practical knowledge, to be acquired only by many years' experience, to determine and advise whether the same shares are a desirable purchase at the advanced quotations—there is a time to buy and a time to sell. It is not difficult to point to cases in which mine shares advance or recede in negociable value (say) 300 or 400 per cent. in a few days or weeks, showing most clearly the absolute necessity on the part of those whose business it is to advise to be as fully acquainted with every financial detail as with the position and prospects of the different properties in which capital is to be invested. The continually fluctuating values, induced in many cases rather by what are known as market operations than the alternating value of the mines, afford to the investor many opportunities of increasing his interest at reasonable prices, and to the speculator chances of realising considerable profits. As we have been for many years extensively and intimately connected with home and foreign mining, and having exclusive sources of information, we do not appear as inexperienced adviser; and while, unlike many questionable firms who are now thrusting themselves before the public, we always hesitate to promise the realisation of fabulous profits, yet the past has taught us that larger profits are to be gained from well conducted mines than any other description of security. We have indicated the class of mines, and specified several we should select, and, in advising what to avoid, we are compelled to be reticent in so far as publishing the actual names of mis-called mines, of which there are so many at present before the public. We are sorry to say that we could make a very long list, the whole of which might be justly placed in this black category. Investors or capitalists cannot be too circumspect or careful in whom they place their trust; one false step may lead to direful results, embittering those upon whom they fall against that channel of investment which, if legitimately and honestly pursued, favourably compares with most in point of security, and surpass all in the amount of profit it yields. Accept dubiously the glowing promises of those who have a direct interest in the mine they recommend, doubt the liberality of those who are anxious to dispose of an El Dorado for a mere song, ascertain the financial condition of the mine, and the position of those associated with it, and, above all, seek sound and trustworthy advice before and not after, as is too often the case, capital is invested. With these few introductory remarks, which are made with a view of producing a salutary effect upon those who lack knowledge upon these matters, we will proceed to refer as concisely as possible to a few mines deserving immediate attention."

SYSTEMATIC INVESTMENTS.—So many are now engaged in the buying and selling of stocks and shares, and in speculations connected with freeholds, leaseholds, mortgages, &c., that the value of a systematic record of transactions—of a special system of book-keeping for investors, in fact—accompanied by tables to facilitate calculations absolutely necessary to investors and to those who deal for them, will be more extensively recognised than ever. Such a combination of tables and account-books* was devised some short time since by Mr. BERNARD CRACROFT, of Austinfriars, and the system was so fully appreciated by the public that a second edition has already become necessary. The author remarks that investors have seldom the time, and if time, seldom the knowledge required to devise such a record. As year succeeds year, loose memoranda are apt to fall astray, and a slip of memory, the merest accident, may lay the foundation of endless trouble—perhaps irreparable injury. The first three sections are destined to enable a reliable record to be kept of stocks or shares bought or acquired, and sold or disposed of; and of a stock and share general account. The second part, embracing the next nine sections, is designated the Solicitor's Record, and includes pages for recording complete particulars of freehold and copyhold property, leaseholds let, leaseholds held, mortgages held, mortgages effected, insurances, bills of exchange and promissory notes, moneys lent and borrowed; and in the third part tables are given for making all the principal calculations required by either investors or stockbrokers, as well as tables of reciprocals, contango and commission tables, and useful memoranda. To those having large transactions in investments, whether they be stocks or shares or landed property, the book will prove extremely useful, and will induce an amount of order and regularity which cannot fail to be beneficial.

* "The Investor's and Solicitor's Record of Purchases, Sales, Freehold and Copyhold Property, Leaseholds Let and Held, Mortgages Held and Effected, Insurances, Bills of Exchange, Promissory Notes, Moneys Lent and Borrowed, and Calculation Tables adapted to every Investment." By BERNARD CRACROFT. London: Effingham Wilson, Royal Exchange.

PRACTICAL PLANE GEOMETRY.—The popularising of science teaching by the institution of Government examinations in science and art has rendered the publication of cheap text books absolutely necessary, as the examinations are availed of, it might almost be said chiefly, by those to whom the expense of books is a very material consideration. Amongst these cheap manuals, that by Mr. J. W. PALLISER, of the Leeds School of Art and Science, just issued by Messrs. Simpkin, Marshall, and Co., will doubtless take a prominent position. It is entitled "A Complete Course of Problems in Practical Plane Geometry, adapted for the Use of Students preparing for the Examinations conducted by the Science and Art Department," and as the price has been fixed as low as 1s. 6d. few can complain that it is beyond their reach on account of its cost. The book is designed to supply the necessary information for enabling art students to pass a first, second, and third grade in "practical geometry:" and science students to get up their "practical plane geometry," and appears well calculated to answer this purpose. As thin lines are used for the *given* lines, whilst the *working* lines are dotted, and the *result* lines thickened, the explanations and mode of solving the problems are very readily understood; indeed, the book, as a whole, is all that the diligent student aspiring to the honours obtained from passing the examinations of the Science and Art Department need wish for.

GRIFFIN'S SHILLING MANUALS.—The first two volumes of the series to be issued under this title have just been published, and the fact of Mr. JOHN TIMBS, the well-known author of "Things not Generally Known," being the editor will explain the nature of the information which the books contain. Each volume consists of about a hundred pages, and contains, perhaps, a hundred and fifty interesting extracts from varied and reliable sources, each complete in itself. Mr. Timbs very truly remarks that in this age of cheap books their practical worth depends not so much upon the quantity of their contents as upon their soundness, gained by condensation, the results of time and experience, which reject what is no longer essential. The volume entitled "Popular Science" embraces accounts of the Sun, Moon, Stars, and Meteors; of the Earth, its Crust and Interior; of Animal and Vegetable Life; of Light and Sound; of Science—Old and New; and of Inventions and Discoveries. The second volume contains "One Thousand Domestic Hints in the Choice of Provisions, Cookery and Housekeeping, New Inventions and Improvements, and various branches of Household Management. To those who require a general knowledge of some of the more prominent facts connected with the subjects treated, there are probably no books from which that knowledge can be more quickly and agreeably obtained than from Mr. Timbs's, whose books, moreover, have the advantage that, whether we have five minutes or as many hours leisure, they will afford amusement and instruction, and permit of a return to them with equal interest on a future opportunity.

THE DUDLEY MINING ENGINEERS.

The usual monthly meeting of members took place on Monday, at the Mechanics' Institute, Dudley. Mr. W. NORTH presided, and there were also present Messrs. G. Taylor, J. Hughes, T. Latham, R. Latham, J. Rogers, J. Cole, Thomas Parton, H. M. Morrison (Manchester), J. M. Fellows, I. Meacham, W. Spruce, W. H. Hall, H. Johnson (hon. sec.), and H. Johnson, jun. (assistant secretary). It was announced by the hon. secretary that Mr. Morrison had promised a paper on the invention of a small winding-apparatus, to be worked by an engine instead of horse-power, as is the case with the present clumsy wooden gins. Mr. Johnson then exhibited Mr. Hollier's new fossil, *Eophrynus (Curculioides) Prestwici*, figured and described by Mr. H. Woodward in a recent number of the "Geological Magazine." The members present expressed their surprise and pleasure at the sight of the very perfect fossil, and high praise was awarded to a pair of casts taken from it by Mr. H. Woodward, who is also the curator of the British Museum. Later in the evening, Mr. HOLLIER, in answer to a vote of thanks awarded him, said the fossil was unique, so far as that district was concerned. The authorities of the British Museum were very anxious to have the fossil, and if they did he hoped he should have a number of casts to give to local museums and to his friends. (Hear, hear.) The fossil was found in the clay ironstone nodules of the district, and more attention ought to be given to the inspection of these nodules, in order that they might discover other specimens which were, up to this time, supposed to be found in the Shropshire coal field alone. In stating that the fossil came from the south-west of Dudley, he added that it came from the Ten-feet bines ironstone, immediately overlying the Thick coal.

The hon. secretary then exhibited, by means of powerful microscopes, transverse sections of coal, and other English and foreign minerals. Mr. Hollier exhibited rock specimens by means of the polariscope. Transverse sections of American coal and Rowley Regis basalt were particularly admired. The object of exhibition was to show the vegetable origin of coal, which was clearly demonstrated.

The HON. SECRETARY said he had pleasure in referring to the explorations of Mr. J. S. Dawes, in search of coal at Hales Owen. This, it will be remembered, is in the southern portion of the coal field, which was formerly supposed to contain the coal measures that had been so productive further north, but was afterwards found to be uncertain, so that it was considered improbable that any workable seams would be met with. Mr. Dawes had been sinking and exploring during the past seven years, at a cost of about 20,000*l.*, and he had at length discovered a portion of the Thick coal, 14 feet thick, after driving 1005 yards from the pit bottom. There were two shafts, one 8 ft. and the other 11 ft. diameter. A thin coal, about a yard thick, was found at a depth of 308 yards, and at 420 yards they came upon the Upper Ludlow limestone. The driving of the 1005 yards was towards Old Hill, and the last portion—about 200 yards—was in much disturbed ground, which terminated at a downfall fault, and this brought in the Thick coal. As the roof rose and the floor dipped, it was confidently expected that the full thickness of the Thick coal would be found at a short distance from where the workmen now were engaged. Mr. Dawes had 1000 yards yet to drive through Lord Lyttelton's property, in the direction of Mr. W. H. Dawes's mines at Haden Hill and Golden Orchard. A jackey pit had been sunk in the Fourteen-feet, which was found to be good coal, and in a fortnight's time the bottom of the gate-road would be benched up, and the coal open for inspection. None should be more pleased with the success of Mr. Dawes than the members of that Institute, for he had fought the battle of finding the Thick coal well, and almost single-handed.—In answer to the Chairman, the HON. SECRETARY said the discovery did not affect the prospects of Wassel Grove. He might also add that the 1005 yards lay perfectly dry and level, and the black bat, which usually lay on the top of the Thick coal, was as thick and as kind-looking as anyone could wish. (Hear, hear.)

Mr. JOHN HUGHES called attention to the report of Mr. J. P. Baker, the Government Inspector for the district, and said he had not the slightest doubt but that the members must have read with pleasure that the number of deaths from mining employments had fallen off 30 per cent. since the Government Inspector had taken office, and a decrease of 25 per cent. during the year. Such a report ought to stimulate everyone having charge of mines to prevent, as far as possible, accidents or fatalities. This, he believed, could be done easily, if they had the co-operation of the deputies and the workmen. (Hear, hear.)

The CHAIRMAN said the report had altogether a pleasant feature, and there really had been a great decrease in the number of deaths, compared with the quantity of material raised.

THE MINERS' CONFERENCE.

The Conference of representatives from the various colliery districts was held in the Mechanics' Institute, David-street, Manchester, on Monday and following days,—Mr. A. MCDONALD in the chair.

The CHAIRMAN, in his opening address, said that no former Conference had so full and direct a representation of the miners of the country. He read a letter from Mr. C. Neate, in which he said:—"I do not think there is cause to regret the failure of the very imperfect Bills introduced by the Government. No Bill, in my opinion, is worth having which does not provide much better than the Government Bill did for effectual inspection, and also for the appointment of certified managers, whose certificates should be liable to be suspended or revoked in case of neglect or incapacity." Mr. Neate added:—"It is the preponderance in Parliament of the proprietary interest which is the real difficulty in the way of more effectual inspection. It also to some extent excuses the Government from bringing in a better Bill. Let it be a reason for the working miners to combine on their part, and act energetically together for the attainment of objects in which the public have the same interest as themselves." He (the Chairman) gave Mr. Bruce credit for his goodness of heart in desiring the education of the miners' children; but he could not too strongly protest—and he hoped the Conference would join in protesting—against the education clauses of the late Mines Regulation Bill, as being illusory and utterly incapable of being carried out. Mr. Bruce, again, had stated that "the miners' proposals are to increase and place the responsibility of the Government in an entirely different position from that which it has occupied." He totally denied that statement. At the present time the Home Secretary was alone responsible for the carrying out of the Mines Acts. Direct inspection of mines was carried out solely under his authority; and for any failure in the enforcement of the provisions of those Acts, for any slaughters that were committed in consequence of neglect of those provisions, he held Mr. Bruce, jointly with the inspectors of mines, responsible. The miners had no desiree to see the right hon. gentleman overworked; on the contrary, they desired that he should have less to do, and that a Minister of Mines should be appointed, who should be charged with the carrying out of the Acts. It was further alleged that they wanted to take away the responsibility of the mineowner. This he denied. The present system was not one of inspection; it was a *quasi* paternal arrangement, joined to kind feeling, without anything like force or character. The miners wanted more—they wanted detection. The present system had no good feature; the inspectors did not act in any way calculated to detect violations of the law: it was even the practice of some to send intimation to the manager on visiting the mines. A new law undoubtedly was wanted, but a proper enforcement of the existing law would put an end to explosions in mines. Any future Act should contain provision for the appointment of certified managers; every mineowner should be compelled to keep a register of the condition of his mine daily, in a book open to inspection; and active and not ornamental inspectors should be appointed. They should, moreover, insist upon the regulation of mines being taken out of the hands of the Home Secretary, and placed in those of a responsible Minister of Mines. One of the subjects for discussion during the Conference would be the truck system. He was sure working men generally would assist them in demanding that the system should be at once abolished. If employers acted in defiance of the law, he hoped the law would provide that, upon conviction, after a first offence, every employer so acting should be sent to prison for a month with hard labour. The dishonest employer should be placed in the same category as the habitual criminal. There was another remedy for the truck system—weekly payment of wages, which should be made compulsory by law. In order that their views on these subjects might be adequately enforced in the House of Commons, it was necessary that they should have a direct representation; and he recommended the formation of a fund, which should have for its object the returning of one or two of their number, who could speak fearlessly before Parliament. He rejoiced in the general adoption throughout the country of the nine-hours system. The Conference should resolve that, from Jan. 1, 1872, the miners of this country should work only eight hours per day. Until proper inspection was provided, with the Government, jointly with the existing inspectors, must rest the responsibility of the calamities which were of such frequent occurrence.

Mr. W. PICKARD (the Vice-Chairman) said that the Miners' Committee in the Wigan district had been trying to provide a remedy for defective inspection, but the class interests of the House of Commons would not allow them to carry out their plans. He did not mean to say that the present inspectors did nothing, but they were not able to keep up with the accidents in their districts. In asking for additional inspection they had the majority of the inspectors with them. Seven out of the twelve inspectors had gone to the Home Secretary and asked for assistance in their work. There was one point which the miners in his district considered most important, and which they thought the Conference should not allow to pass without consideration. They had had 317 men sacrificed in the Wigan district in six or eight general explosions, leaving 200 or 300 children and 100 or 200 widows destitute. They wanted Government to interfere, and not allow any master to ventilate two or three seams with one shaft. There was no protection for life where one shaft supplied two or three seams, and so long as such a mode of ventilation was continued explosions would occur.

Mr. HUNT (St. Helens) reported eight pits in his district with two seams ventilated by one shaft.—Mr. T. HALLIDAY (Farnworth) said the deaths from accidents and explosions would be very much lessened if they had practical men as inspectors to go and ferret out the evils connected with the pits.—Mr. BOWEN (North Staffordshire) considered that inspection would not be perfect until they had a staff of inspectors who could visit every mine and every working place in the pits once every three months.

Mr. HALLIDAY moved a resolution to the effect that a memorial should be drawn up, to be signed by every person present, asking the Government to introduce a satisfactory Mines Regulation Bill, and that copies should be forwarded to the Prime Minister and the Home Secretary, which was seconded and carried.

Mr. BROWN, referring to his district, said that black-damp was found in almost every mine in South Staffordshire. In some places the men had to use two or three candles, placed in a diagonal or horizontal position, or they could not work at all. The mines, as a rule, were badly ventilated. The men were much overworked. In many cases they went to work at 5 o'clock in the morning and did not leave the mine until 6 o'clock in the evening. This was a great evil. During all that time the men had to work in an atmosphere contaminated with carbonic acid gas, which broke down their constitutions. His belief was that carbonic acid gas, in the mines of both North and South Staffordshire, destroyed more human life than explosions of fire-damp. An explosion carried off, perhaps, 40 or 50 men at distant intervals, but carbonic acid gas was doing its deadly work continually.

Mr. DIXON, a delegate from West Yorkshire, said that as far as his experience went the mines were well managed, and the men were fairly situated. The Government Inspector had reported that during the past year there had been 46 accidents, causing 90 deaths. There were 417 collieries in the district, employing 36,000 men, yet there was only one inspector. That one, however, was very active in the performance of his duties. The chief source of danger was the presence in the mines of carbonic acid gas. More thorough inspection was wanted to ensure the safety of the men.

Mr SILKSTONE (South Yorkshire) said the complaint of the men in South Yorkshire was that under the present system of inspection there was not that protection which ought to be afforded. Nothing would improve ventilation so much as an increase in the number of shafts. They were also in favour of the appointment of sub-inspectors. The colliery where he himself worked was so carefully managed that during the last 34 years only two lives had been lost. With good management these calamities might be put an end to. He had worked at that colliery for upwards of 20 years, and had never seen an inspector.

Mr. H. MITCHARD (Monmouth) considered that there was no inspection of the mines in his district, inasmuch as the inspectors only visited the pits after an explosion. What was wanted was the appointment of a practical sub inspector to visit the mines previously to an explosion, and to examine the places where proper ventilation was impossible. Better air-ways were also required in pits.

Mr. PICKARD observed that the Government tables showed that in West Scotland one man was killed to every 893 men employed; while in South Wales one man was killed to every 178 men employed,

Mr. MOUNTJOY (Forest of Dean) said his district was in a very disorderly state. Inspection in the Forest was no better than in other places. He had lived in the district all his life, and had never seen an inspector. Generally the inspector gave notice before visiting a mine. Consequently, everything was put in order, from the engine-house to the bottom of the pit. Inspection, too, was usually made after an explosion. When he was a boy the ventilation in the Forest pits was of a most disgraceful and unhealthy nature. Foresters were, therefore, greatly dissatisfied with the present mode of inspection, and would never be satisfied until it was improved. He thought managers should be appointed who understood their business a great deal better than many of the Forest managers did. They seemed to care little or nothing about the lives or the health of the men so long as their own pecuniary interest was secured. Many lives were lost in the Forest in consequence of the horse-roads being improperly timbered, and they ought, therefore, to be examined more frequently.

Mr. BURT (Northumberland) said he had worked in one mine seventeen years, and during that time he had never seen an inspector underground. The present system of inspection was, therefore, very unsatisfactory to the working miners. He contended, however, that the men should not be required to send information to the inspector, who ought to visit a mine without any request being made to him. Still this course was practised in his district, and was found to work satisfactorily.

Mr. NIXON (Northumberland) also said that the majority of the miners in his district would not be satisfied unless men were appointed who would regularly inspect the mines, and report upon the state of things existing in the pits.

Mr. NORMANSELL (South Yorkshire) considered that an inspection ought to be made before an explosion and not afterwards, when many catastrophes might be prevented. Parliament had been petitioned with reference to this question for many years; but owing to the want of organisation amongst miners in the various districts, and by not pressing the subject upon the attention of their parliamentary representatives no good result had followed the memorialising of the Legislature.

The CHAIRMAN thought it could not be too strongly urged that, until they had a system of inspection which was thoroughly effective, not to manage, but to detect, and if necessary to punish, the miners would not feel that their lives were properly protected.

Mr. HUGHES, of Dumbarton (in the course of the discussion on the provision of a Mines Bill), proposed, and it was resolved, "That in the opinion of this Conference, assembled from all parts of the United Kingdom, no Mines Inspection Bill will be satisfactory which does not extend to every description of mine—coal, iron, shale, lead, copper, &c.; and, upon the proposition of Mr. JACOBS (Somersetshire), it was also resolved "That no system of inspection will be deemed satisfactory which does not enforce the inspection of each separate mine at least once in every three months."

Mr. J. WEST (Wigan) next moved—"That in the opinion of this Conference mines inspection will not be efficient or useful until there be appointed a large staff of sub-inspectors, this being more necessary, when we consider the rapid development of the mines of this country," and the motion was seconded; but Mr. DAVIES (Aberdare) moved an amendment that the words "practical mine-

should be embodied in the resolution as the qualification of the sub-inspectors; and a long discussion followed as to whether "practical" should mean that all candidates for sub-inspectorship must have "cut coal." This view was supported by several of the delegates, while others, on the contrary, contended that persons who had made themselves acquainted with the working and ventilation of mines, by actual observation and study, should be eligible for the appointment. A compromise was ultimately effected, by accepting Mr. Halliday's suggestion that the sub-inspectors must "have had practical experience."

Amongst the other resolutions adopted in connection with this subject were.—1. That any system of mines inspection to be satisfactory must be such as to compel the inspectors to make a daily record of their visits to the mines in their respective districts, such record to contain an account of the condition of each mine, to be sent to the Home Secretary every three months, or the Minister of Mines to be appointed.—2. That in the opinion of this conference, the owners of mines should be compelled to make a daily registration of the ventilation and of the real state of the mine, in all its appliances, for the safety and protection of the workmen, the registration book to be opened at all times for the inspection of the inspector of the mines in the district.—3. That in the opinion of this conference a barometer and a thermometer should be placed in every mine to show the state of the atmosphere at all times.—4. That this Conference considers that the words, "under ordinary circumstances," in the first general rule to be observed by mineowners, or proprietors, and their managers, give such owners of mines an opening to evade the law; and, therefore, urgently requests the Government, in preparing of a Mines Regulation Bill, to leave out such words.—5. That in the opinion of this Conference all persons becoming managers and other officials of mines and collieries should pass an examination by some board for the purpose of proving the fitness and ability of such persons for the management, and should hold a certificate given by such board before such persons be allowed to undertake the duties of management, such certificate to be liable to forfeiture when the holder is proved to be guilty of neglect.

The CHAIRMAN, referring to the last-mentioned resolution said this principle had been insisted upon since the year 1850, and Mr. Bruce in bringing in his Bill actually admitted that many human lives were lost in consequence of the incapacity, and the want of proper training on the part of the managers. He might also mention that, in reply to that eminent authority, Dr. Lyon Playfair, the right hon. gentleman said he could not recommend the House to adopt the views of the miners. If the civil and marine services required high attainments on the part of candidates for those services, he held that high attainments should also be required of those who had to deal with human lives. If that were done, the result would be the appointment of excellent sub inspectors.

After a discussion upon the examination of mines by the firemen, the motion was unanimously adopted.

Mr. J. OLDFIELD (South Yorkshire) next moved, "That, in the opinion of this Conference, the mining interest has become so extensive as to render it impossible for any Home Secretary to see carried out the Mines Inspection Bill, and believes it to be requisite and necessary to appoint a Minister of Mines, who should have a seat in Parliament, and whose duty should be to attend to all matters connected with mining operations, and the carrying out of the regulations laid down in the Mines Inspection Act," and the motion was seconded and adopted without comment.

Mr. NORMANSELL said he had gathered from experience that where safety-lamps were exclusively used—though many people believed that there were no safety-lamps—blasting with gunpowder ought to be strictly prohibited in those mines, and he moved a resolution to that effect.

Mr. BROWN contended that, when a collier made application for work in a mine where the Davy lamp was in use the miners ought to know something about the practical knowledge of the applicant. Greater sacrifice of life had occurred from the use of lamps by inexperienced colliers than from any other cause.

The CHAIRMAN suggested that blasting should be prohibited in mines containing gas in dangerous quantities. It was highly important such a rule should be incorporated in the Mines Bill, inasmuch as it had been proposed that the inspectors should have the power of determining where blasting should take place and where it should not. If, however, an inspector had a brother who was the owner of a mine he might strain the matter considerably in order to give his relative an opportunity of getting his work done a little cheaper. It was just as necessary that a general rule should be applied to blasting as to any other operation.

Mr. HALLIDAY moved, as an amendment—"That this Conference is of opinion that in all mines or collieries where gas is thrown off in dangerous quantities blasting with powder should be strictly prohibited by a general rule in the Mines Bill."

Several of the delegates objected to the resolution, on the ground that gas might exist in one part of the mine only, while the other parts were perfectly free. The further discussion of the question was eventually postponed until Tuesday morning.

On the motion of Mr. JACOBS, seconded by Mr. THOMAS (Bristol), it was resolved—"That in the opinion of this Conference the employers of miners and colliers should be compelled, by a clause inserted in the Mines Bill, to provide sufficient prop-wood necessary for the safety of the workmen, and deposited in some place in which the men have to work."

Amongst the resolutions subsequently proposed were—1. That when safety-lamps are used in any colliery, mine, or working place it is the opinion of this Conference that blasting with gunpowder, or any other inflammable substance, should be strictly prohibited.—2. That where doors are used, or travelling roads, for the purposes of ventilation, and through which there is a transit of persons and material, it is the opinion of the Conference that some responsible person should be constantly placed at such doors during the working hours.—3. That in the opinion of this Conference, whenever there is in any mine repeated violations of the Mines Inspection Act, although no evil results, either in injury to health or sacrifice of life may arise from such violations, the owner or responsible manager shall be liable to imprisonment not exceeding three months.—4. That in the opinion of this Conference it is necessary, for the protection of life in and about mines and collieries, that all old shafts should be securely fenced with brick and stone.—5. This Conference is of opinion that all brakesmen and engine-keepers having charge of the engines connected with mines and collieries shall be well known to be competent persons to discharge their duties.—6. That in the opinion of this Conference the name of the manager of each mine or colliery should be placed in a prominent and conspicuous place, in order that it may be seen by every person employed in such mine or colliery.—7. That in the opinion of this Conference in all engine planes and inclines where it is necessary for persons to travel to and from their work there should be proper refuge places or holds, with sufficient space, at distances of not more than 10 yards from each other, or a separate travelling way—separate roads being strongly recommended.—8. That in the opinion of this Conference all shafts over 20 yards deep where persons have to ascend or descend, should be provided with proper means of signalling from bottom to top, and from top to bottom.—9. That in the opinion of this Conference provision should be made in the Mines Bill, compelling all proprietors of mines to provide and station some suitable person at the engine used in lowering into and raising therefrom the workmen employed by them in any mine during the time any workmen are in the mine, so that such workmen may be raised to the surface in case of necessity.—10. That this Conference is of opinion that the name and address of the inspector of mines should be printed with the special rules of each colliery or mine, and that the name and address should also be placed in a conspicuous place, that it may be seen by the persons employed in such mine or colliery.—11. That where workmen have to travel on any engine or incline planes where more than one train, cowe, or tup-wagon have to travel at one time a light should be placed in the front of the train, in order to be a signal to any workmen of the danger.—12. That when the special rules of any colliery or mines are supposed to be contrary to statute laws, or unfair and unjust to workmen, there should be right of appeal to a Court of Arbitration on the part of the workmen.—13. That all mine owners should be prohibited from allowing men to descend or ascend any upcast or cupola shaft used for the purpose of an escape shaft from gas, smoke, or steam.—14. That at all escape shafts apparatus should be provided for lowering and raising men, and that there should be a travelling way, at least 4 ft. wide and 3 ft. 6 in. high, leading to such shaft.

Mr. BAILEY addressed the Conference on international arbitration, asking the delegates to bring the subject before their various lodges and districts, to get, if possible, international disputes settled by arbitration instead of going to war; and a resolution was passed "That this Conference, having heard the statement of Mr. Bailey, a representative from the Peace Association, is of opinion that the question should be laid before the various districts represented at this Conference by those delegates who may think proper to do so, believing that such a course will be best to keep this assembly entirely outside the pale of any political party."

With regard to the truck system, it was resolved—"That in the opinion of this Conference, a clause should be incorporated in the Mines Bill compelling proprietors of mines and collieries to pay the wages of their workmen weekly without any deductions whatever, as we believe if such payments were made compulsory it would prove to be a great moral and social good to the men, as well as a very important auxiliary in destroying the system of 'truck' which now exists in the mining districts in a disguised form, and by which the law is evaded." The Northumbrian delegates, while not opposing the motion, said they could not vote for it; they had fortnightly pay, and no truck whatever. It was next resolved—"That in the opinion of this Conference, the Government should insert a clause in the Mines Bill preventing proprietors of mines from keeping or having any interest in any truck shop, or exacting large rents for the use of such shops, and make provision also for the imposing of a fine of 100*l.* for being connected with or receiving profits therefrom." And it was further resolved—"That no general Truck Bill will be sufficient unless the foregoing provisions are embodied in it."

It has frequently been asserted that the present system of weighing and measuring coal is unjust to the men, and it was resolved—"That it is the opinion of this Conference that weighing-machines should be placed on every pit bank in the country, and all coal, ironstone, and other material produced by the miners by piece-work should be truly weighed by the imperial standard weights of the country; and that all such weighing-machines be placed under the supervision of the Inspectors of Weights and Measures now in existence, with full power to prosecute in all cases of violation under this Act."

Mr. CHARLEY, M.P., who attended the Conference to deliver an address, said that his opinion was that when they were dealing with the question of a Mines Bill they ought to act in a large and comprehensive spirit. Let it not be confined to coal mines only, but let it extend to lead, shale, copper, and other mines. He did think that it was a pity for the Government to introduce, session after session, a measure of this sort without being able to carry it. At the same time, he would strongly advise them to avoid anything in the nature of threats, but by all means let them use the constitutional weapons with which they were endowed for the purpose of attaining their object.

Resolutions were passed recommending the Government to pass a measure making it imperative that stipendiary magistrates be appointed in all great centres of industry, and to bring in a measure to prevent any more females being employed about mines. It was further resolved to recommend to all mining districts the necessity of commencing the eight-hours system as early as possible, this being the more necessary and just when we consider the great reduction which has taken place in all kinds of labour during the past few months.

The CHAIRMAN thought it was in the power of working men to return members of their own class to attend to their interests. It was conceded on both sides that the House of Commons would not be disgraced, but the opposite, by having a few working men representatives there. Let working men take the matter up, and if they did not, let them cease to grumble, and say that they were suffering from class legislation. He was of opinion that the State should not pay its representatives. If working men wanted direct representatation they must pay for it; and if their members did not do their duty, then let them tighten the mouth of the money-bag.

The last resolution passed was "That in order to bring about those changes we are seeking in the law for the protection of the miner's life, health, and labour, the Conference strongly recommends all the mining districts in the country to get themselves thoroughly organised, in order that their power may be felt in Parliament, and other places where the mining interest at the present time is almost totally excluded."

On the motion of Mr. HALLIDAY, seconded by Mr. HAYCOCK, a resolution was passed agreeing to leave the carrying out of the agitation in the hands of the executives of the National and Amalgamated Associations.

This concluded the business of the Conference.

FOREIGN MINING AND METALLURGY.

Great activity continues to prevail in the Belgian iron trade, and a continuous rise appears to have been taking place in prices. Some works quote iron at 7*l.* 4*s.* per ton, and several houses have advanced the prices of plates this week 16*s.* per ton. Special pig has considerably hardened in price, choice minerals having experienced a sensible rise. Several important contracts for rails for Hungary are stated to be in course of negociation in Belgium; it is also intimated that the Hungarian Government has relaxed some of the *cahiers des charges*, with regard to rails, as they were considered too severe. The rail rolling mills of Belgium may now be said to be in full activity. The demand for special iron is very considerable, and makers are overdone with orders. The Dyle Works—Messrs. Durieu and Co., of Louvain—have just completed the last span of a great iron bridge intended for Russia. A strike which has continued for some time among the working mechanics of Gard does not appear to be yet adjusted. The Belgian Railway Plant Construction Company has announced a dividend of 1*l.* 16*s.* per share for 1870-1; this dividend will not be paid, however, until March 1, 1872. An issue of 800 shares remaining on hand is also to be made by the company. The John Cockerill Company has announced a dividend of 3*l.* 4*s.* per share, payable March 1, 1872. The Central Belgian Rolling Mills Company (at La Louvière) has been paying, since Oct. 20, a dividend for 1870-1 of 5 per cent. upon its fully paid up share capital.

The French iron trade has been characterised by some rather important transactions. Some parts of France are beginning to feel the influence of the German Customs tariff upon the products of Alsace and Lorraine. As these products are finding a much more advantageous sale in Prussia, the Ardennes district is obliged to provide for its requirements elsewhere, and many orders have been forwarded into the Haute-Marne. In the Loire district the cannon foundries are pursuing their trials and experiments with activity. The last experiment made with steel breech-loading cannon, on Col. Reffye's system, seems to have solved the question of the superiority of steel over bronze in connection with the manufacture of pieces of artillery. Prices of iron have not experienced any material change. The Montataire Forges and Foundries Company will pay, Nov. 15, a dividend for 1869-70, or 1*l.* per share.

The Franco-Austrian Railway Company produced last year at its Reschitza Works 3629 tons of steel, against 2389 tons in 1869. The augmentation of 1240 tons established in the production last year would have been still more considerable but for a grave accident, of which some of the employees attached to the establishment were victims in the course of the winter of 1869-70. This accident involved a stoppage of the works for nearly three months. In the total of 3629 tons of steel produced last year, Bessemer steel figured for 2202 tons, or 840 tons more than in the preceding year. In the Bessemer steel made by the company last year rails figured for 1620 tons, and weldless tyres for 164 tons.

On all sides there are complaints that the condition to which the Belgian coal trade has been reduced by the want of rolling stock is becoming intolerable. The Belgian Coal Trade Association has appointed a committee to enquire into the distribution of plant among all the railway companies. While awaiting the very doubtful results of this enquiry, the association has intimated to all the great works that it cannot undertake to execute any fresh contract so long as the present state of affairs remains unmodified. The authorities of the State lines are making efforts to avert the coming storm, but hitherto their measures have not been very successful. The situation is attended with still graver results for the ironmasters than for the colliery proprietors. The latter are certainly witnessing every day some increase of their stocks, but they are not yet reduced to idleness, while from all sides intelligence comes to hand that the rolling-mills are on the point of suspending operations, in consequence of the want of combustible. Prices have not varied, except in some exceptional cases. It does not appear probable that any advance in prices is imminent, except as regards coal for domestic consumption. The Basin of Charleroi United Collieries Company is now paying a dividend of 16*s.* per share for 1870-1.

The want of rolling-stock is felt in France, but to a less extent than in Belgium, as the French railway companies give colliery proprietors a preference in the distribution of their rolling-stock. The price of coal has not experienced much change upon the French markets, but has been firmly maintained. The dividend of the Carmaux Mines Company for the first half of 1871 has been fixed at 8*s.* per share. The Bességes Colliery Company is now paying an interim dividend of 12*s.* per share in respect to 1871. The Blanzy Mines Company commenced the payment, on Monday, of a dividend of 8*s.* per share. The Rive-de-Gier Collieries Company will pay on the 20th inst. a dividend of 1*s.* 3*d.* per share.

The general state of the continental metal markets appears to be tolerably satisfactory. At Paris, Chilian copper, delivered at Havre, has made 72*l.* per ton; ditto in ingots, at Paris, 79*l.* per ton. Tough cake has brought 78*l.* per ton, and Corocoro minerals (pure standard) 74*l.* per ton. The state of the Dutch tin markets continues to be favourable; Banca has brought 81¼ fls., and Billiton 80½ fls.; at the latest dates quotations were a trifle higher. The lead markets have not experienced any modification of importance. At Marseilles lead in saumons, first fusion, has made 18*l.*; ditto, second fusion, 18*l.* 8*s.* per ton; lead in shot, 20*l.* 8*s.* per ton; and rolled and in pipes, 20*l.* per ton. Zinc has maintained its price extremely well. In Belgium the Vieille Montagne Company has carried its rolled zinc to 26*l.* per ton, and its rough zinc at the works to 20*l.* per ton; these rates show an advance of 4*s.* per ton for rolled zinc, and of 2*s.* 6*d.* per ton for rough zinc.

It appears from an official return that the quantity of coal raised from its coal mines during last year by the Franco-Austrian Railway Company was 576,045 tons, or 39,102 tons more than in 1869. The sales effected amounted to 576,859 tons, or 41,473 tons more than in 1869. Of the coal raised by the company last year 378,784 tons came from its Kladno Mines, in Bohemia, 153,279 tons from its Steyerdorf Mines, in the Banat, and 43,982 tons from its Doman and Szekul Mines, in the Banat. The sale of the Kladno coal last year showed an increase of 47,328 tons, as compared with 1869. In the Steyerdorf workings the extraction fell off last year to the extent of 8785 tons as compared with 1869, which was also an unprogressive year.

FOREIGN MINES.

SIERRA BUTTES (Gold).—The result of the clean-up for October is as follows:—Receipts, $18,097: 2812 tons of ore were crushed during the month; cost of mining and milling same, at $4·82 per ton, $13,553·84.

PINTO (Silver).—Captain Plater, Oct. 10: Since my letter of the 26th ult., I have no change to report in the mines of the company. They continue to look well, and, with the exception of the four men employed in running the tunnel, the entire force is engaged in taking out ore, so as to have a supply on hand by the time the mill is completed. We are not making such rapid progress with the tunnel as formerly, the face continuing very hard, and requiring continuous blasting.

UTAH (Silver).—Capt. Nancarrow, Oct. 16: At the end of the present week I shall go to the city to sell a lot of bullion. I should have sold some last week, but we expect a reduction on freight between Ogden and Omaha of $8 per ton, and this amount we shall get extra in price. The mine is looking well, more especially on the Red Warrior and Belshazzar. Also the Portland is producing a large amount of ore of low percentage, but this will improve as we get greater depth. The new furnace is progressing well, and will soon be complete. The foundation has taken a great deal of time, but we have all plain work now. The iron mine is turning out well, and from it we have a good supply.

— The directors received the following telegram on Wednesday:—"Furnace running well. We have smelted since Oct. 11, 244 tons of ore, which has produced 68 tons bullion. Assay, 50 ozs. of silver to the ton. Full reports mailed."

MINERAL HILL (Silver).—The directors announce the receipt, per steamer City of Antwerp, from New York, of 7 bars of silver, value $10,789.

EBERHARDT AND AURORA.—The directors have received a further remittance of 30 bars, per City of Antwerp, valued at 7000*l.*

PACIFIC.—Telegram from Mr. Sewell—"Amount required for last month's pay, $14,000; bars forwarded in ten days, Mettacom Mill working splendidly, 150 tons sampled ready for reduction."

— H. Prideaux, Oct. 19: Since my last we have raised from the mine and assorted from the dump 25 tons of ore; this ore is worth from $50 to $600 per ton. The various points of operation throughout the mine are without change to remark. We are continuously sending ore to the Pacific Company's Mettacom Mill. There is yet on the mine over 100 tons ready to be sent to this mill. We are raising good ore, and shall continue to do so for some time to come.

[For remainder of Foreign Mines see to-day's Journal.]

GOLD MINING IN VICTORIA.—The yield of gold obtained from quartz in Victoria is now about equal to that from the alluvial workings, which in the earlier days of the gold diggings formed the only source from which gold was obtained. As only an infinitesimal portion of the quartz reefs of the colony is supposed to have been as yet discovered, it is maintained that the mining industry will be profitably followed for centuries. The mining registrars' and surveyors' reports estimate the quantity of gold raised in the second quarter of the year 1870 (exclusive of mining in scattered parts, from which returns are not obtained) at 355,430 ounces, or 42,000 ounces more than in the previous quarter; 180,744 ounces from alluvial ground, being an increase of 7000 ounces; and 174,686 ounces from the quartz reefs, an increase of 35,000 ounces. The total of the mining population at the end of the quarter stood at 57,439, of whom 27,084 Europeans and 14,487 Chinese were alluvial miners, and 15,760 Europeans and 114 Chinese were quartz miners. In Collmann and Tacchi's mine, at Sandhurst, the quartz was raised from levels ranging from a depth of 210 feet to 720 feet: the yield per ton was 2 ozs. 8 dwts. from 490 tons. The Albion Company's shaft at Steiglitz is down 868 ft. beneath the surface, and two auriferous reefs have been struck at this depth. There is considerable excitement in Ballarat East on the question of the right to mine under the town. Ballarat proper is now divided into the City of Ballarat and the Borough of Ballarat East, and it appears that shafts have been recently sunk in the borough, and good paying ground discovered. The owners of the soil, who have built upon it, naturally object that undermining their buildings will cause them to subside or fall. The miners appear determined to proceed, with or without consent. Already it is stated that one or more houses have been bought in the borough, with the view of enabling miners to sink shaft in them unobserved, and then drive away from the bottom of the shafts to where the wash dirt is believed to lie. The Custom House returns show an export of 984,130 ozs. of Victorian gold in 1871 up to the end of July, being an increase of 138,737 ozs. over the corresponding period of 1870

CHEMICALS AND MINERALS—Messrs. J. Berger Spence and Co., Manchester, Nov. 8.—The general aspect of the market has been very steady, and a good business is reported. Home consumption remains unexceptionably brisk, and paper-makers absorb a considerable quantity. Alum has advanced in consequence of diminished use of china-clay compounds. There is a good foreign demand for chemicals for the season. Liverpool shipments to the States are lighter. New York advices make the market there dull. Caustic soda scarce, and readily commands full rates; small parcels only obtainable for prompt. Soda ash is unusually steady. Bleaching powder has lost its usual attention, and rates are somewhat weaker; many manufacturers, however, hold out firmly for 12*l.* for next year. Nitrate of soda declines; 15*s.* 9*d.* would be now taken. Iron and copper salts are in much request for exportation. Bichrome quiet, at its high price, 10*d.* The demand for sulphate of ammonia has been pretty fair, and holders ask an advance of 10*s.* Prussiates dear. Muriate of potash rules firmly, with good enquiry. The coal trade enjoys rather more activity, partly on account of the stoppage of some collieries by serious accidents. Prices have advanced, and transit rate to London has been increased 8*d.* Steam fuel very brisk. Another strike of colliers and iron-workers is threatened at Rhymney for an advance of wages. Coke rules high, and no long contracts are taken. The same extraordinary demand for iron ores of every description continues, and is likely to continue for a long time to come; and a few months probably will witness greater energy displayed in the opening up of new sources of supply. Our untouched iron beds are worth attacking, and a strong feeling seems to be setting in in that direction. Plumbago is easier. Imports of petroleum very large. Silver ores, imports increasing. Pyrites in uniform request. Mineral phosphates and coprolites, short supply. Copper, lead, and zinc ores steady, at full rates. Manganese anticipates its decline.

THE RICHARD GREEN PERMANENT BENEFIT BUILDING SOCIETY.—Fair and sweet-scented flowers are oftentimes found blooming on the grave; and the records of the great and good are never so surely or imperishably written as when chronicled on the title-page, or used as the watchword or rallying point of some useful institution, devoted either to the public good, or to the legitimate purposes of private and progressive enterprise. On the death of the late lamented Mr. Richard Green, the eminent and well-known shipbuilder and shipowner, of Blackwall, his surviving friends and representatives expressed a united and warm anxiety to perpetuate in some suitable way the name and memory of so great a philanthropist, whose open-handed generosity was so well known, whose whole life and fortune were devoted to the services of the poor and needy, and the lasting monuments of whose ample beneficence are scattered broadcast over the eastern portions of the metropolis. While the discussion was proceeding as to the most fitting means of effecting this object, it so happened that a resident at Poplar, seeing the great benefits which had resulted from the introduction and spread of building societies, conceived the idea of extending to the East of London the advantages derivable from such institutions. These two separate ideas, though totally distinct, had yet a common blending, and a spirit of mutual co-operation arose on both sides. The building society was successfully founded, and a suggestion from the originator having met with the warm approval of the friends of Mr. Green, arrangements were at once decided upon which led to the adoption of his name as the distinctive title of the society, and as a perpetual and affectionate remembrance of the many good deeds of this eminent man. Thus, then, the twofold object held in view was accomplished, and it is not now to be wondered at that under such patronage as that of Messrs. Wigram, Samuda, and other men of note and influence, the institution has prospered from that day to the present time; for, viewed only with regard to its intrinsic merits, a society of the kind confers the most lasting benefits upon the district to which it belongs, throwing open to the masses the grand franchise of industrial thrift and worldly independence. No sooner was the Richard Green started than the more provident men from the various shipyards and manufactories flocked to the standard thus unfurled, and hastened to secure the advantages which were afforded to them; and by a steady but rapid progress the society has now reached an eminence and success in all its departments which it would be difficult to overrate. The report of the last annual meeting, held at the London Tavern, Aug. 24, shows that the capital exceeds 54,000*l.*, and the rate of interest, with the annual bonus, has for the past five years averaged 7½ per cent. per annum. We can, therefore, strongly recommend it both to intending investors, or those wishing to borrow for the purpose of building or buying property. We may also add, for the information of persons unacquainted with the Richard Green, that the chief office is at 113, Fenchurch-street, E.C.; and the branch office, 307, East India-road, E.

IMPROVED GOVERNOR.—An improved governor, the invention of Mr. BUSS, is at present being introduced by Messrs. Schaffer and Budenburg, of Manchester. At first sight the arrangement appears somewhat complicated, and liable to derangement in use, owing to the number of parts requiring careful lubrication, to prevent sticking; but it is claimed that it is distinguished by great sensitiveness and regularity of action, and that its effect upon the opening and closing of the throttle-valve is certain and instantaneous. It is stated that the inertia and friction are reduced to a minimum, and that under any condition of the load on the engine it maintains a regularity of speed which is unattainable by any known governor. The apparatus is very compact and neat in appearance, so that if the claims put forward for it are established when the governor has been in ordinary use for a few months it cannot fail to be very generally adopted.

IMPROVED ROLLING MACHINERY.—The invention of Mr. JAMES CLARK, of Blaina, refers—firstly, to the use of rolls the axes of which are alternately at right angles to each other; secondly, to rolls with their axes in the same plane; thirdly, to spiral guides for turning the metal; fourthly, to rolling cast-steel from the melted metal.

COPPER ORES.

Sampled Oct. 18, and sold at Tabb's Hotel, Redruth, Nov. 2.

Mines.	Tons.	Price.	Mines.	Tons.	Price.
West Wheal Seton ..	65	£7 3 0	West Basset	27	£1 9 6
ditto	43	2 4 0	ditto	25	12 0 6
ditto	42	2 4 0	Mellanear	60	1 14 0
ditto	41	8 6 6	ditto	45	4 14 6
ditto	37	8 3 0	ditto	40	1 8 6
ditto	24	5 7 0	ditto	10	10 11 0
East Grenville	61	2 1 0	South Crofty	65	3 3 6
ditto	60	1 16 6	ditto	26	1 16 0
ditto	56	5 8 0	Dolcoath	30	4 8 6
ditto	45	2 1 0	ditto	19	2 8 6
ditto	20	5 3 0	South Frances	23	4 2 0
ditto	10	2 9 0	ditto	22	3 11 0
East Pool	99	2 17 6	West Damsel	43	3 6 6
ditto	70	2 17 0	Poldice	37	3 9 6
ditto	50	3 2 6	Champion's Ore	25	5 16 6
ditto	25	3 3 6	ditto	7	2 0 0
West Basset	37	1 1 0	Wheal Grenville	8	7 14 6
ditto	35	2 12 6	Wheal Agar	6	4 17 0
ditto	34	3 3 6			

TOTAL PRODUCE.

West Seton	252	£1423 0 6	South Frances ..	45	£ 172 8 0
East Grenville ..	252	756 14 0	West Damsel	42	142 19 6
East Pool	244	719 15 0	Poldice	37	128 11 6
West Basset	158	579 2 6	Champion's Ore	32	159 12 6
Mellanear	155	477 2 6	Wheal Grenville	8	61 16 0
South Crofty	91	253 3 6	Wheal Agar	6	29 2 0
Dolcoath	49	178 13 6			£3124 7

Average standard..... £102 9 0 | Average produce..... 6¼
Average price per ton £3 14 0
Quantity of ore .....1372 tons | Quantity of fine copper....86 tons 9 cwts.
Amount of money £5082 4 0

LAST SALE.—Average standard..... £101 19 0—Average produce..... 6¼
Standard of corresponding sale last month, £100 12 0—Produce, 6¼.

COMPANIES BY WHOM THE ORES WERE PURCHASED.

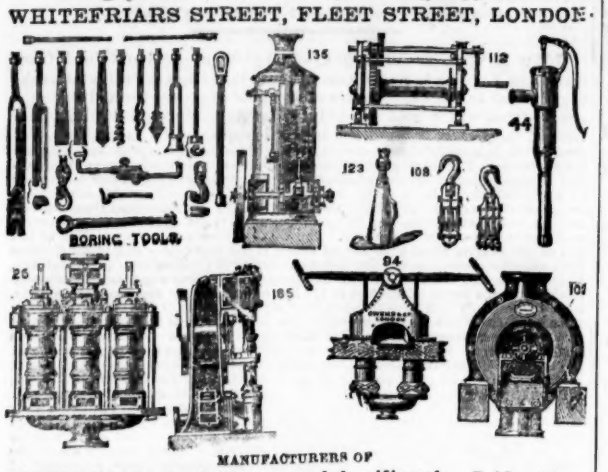
Names.	Tons.	Amount.
Vivian and Sons	197	£ 825 9 0
Grenfell and Sons	215	1510 15 0
Sims, Willyams, and Co.	97½	340 3 9
Williams, Foster, and Co.	149½	396 11 3
Mason and Elkington	535	995 5 6
Copper Miners' Company	278	523 9 0
Newton, Keates, and Co.	100	490 10 6
Total	1372	£5082 4 0

NO SALE on the 9th or 16th of November.

S. OWENS AND CO.,

Hydraulic and General Engineers,

WHITEFRIARS STREET, FLEET STREET, LONDON.



MANUFACTURERS OF

BORING TOOLS, for testing ground for Minerals. Bridge Foundations, Artesian Wells, &c., to any depth.
No. 26.—Treble Barrel and other Deep Well Pumps.
No. 136.—Vertical and other Portable Steam-engines.
No. 185.—Horizontal and Vertical Steam Pumping-engines.
No. 112.—Single and Double-purchase Crab Winches.
No. 108.—Pulley Blocks of all sizes.
No. 123.—Bottle and other Lifting Jacks.
No. 94.—Double-barrel Pumps, for Mine or Quarry use
No. 44.—Portable Wrought-iron Pumps, ditto ditto
No. 102.—Bernays's Patent Centrifugal Pumps, of all sizes.

ALSO EVERY OTHER DESCRIPTION OF
HYDRAULIC AND GENERAL MACHINERY,
COMPRISING
TURINES, WATER WHEELS, WIND ENGINES,
THE HYDRAULIC RAM, FIRE ENGINES, &c.
Catalogues and Estimates on application.

M'TEAR AND CO.'S CIRCULAR FELT ROOFING

FOR
GREAT ECONOMY
AND
CLEAR WIDE SPACE.

For particulars, estimates, and plans, address,—
M'TEAR & CO.,
20, BUDGE ROW, CANNON STREET, LONDON;
54, PORTLAND STREET, MANCHESTER;
OR,
CORPORATION STREET, BELFAST.

The above drawing shows the construction of this cheap and handsome roof now much used for covering factories, stores, sheds, farm buildings, &c., the principals of which are double bow and string girders of best pine timber, sheeted with ½ in. boards, supported on the girders by purlins running longitudinally, the whole being covered with patent waterproof roofing felt. These roofs so combine lightness with strength that they can be constructed up to 100 ft. span without centre supports, thus not only affording a clear wide space, but effecting a great saving both in the cost of roof and uprights.

They can be made with or without top-lights, ventilators, &c. Felt roofs of any description executed in accordance with plans. Prices for plain roofs from 30s. to 60s. per square, according to span, size, and situation.

Manufacturers of PATENT FELTED SHEATHING, for covering ships' bottoms under copper or zinc.

INODOROUS FELT for lining damp walls and under floor cloths.

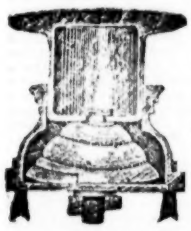
DRY HAIR FELT, for deadening sound and for covering steam pipes, thereby saving 25 per cent. in fuel by preventing the radiation of heat.

PATENT ASPHALTE ROOFING FELT, price 1d. per square foot.

Wholesale buyers and exporters allowed liberal discounts.

PATENT ROOFING VARNISH, in boxes from 3 gallons to any quantity required, 8d. per gallon.

THOMAS TURTON AND SONS,



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CAST STEEL for PUNCHES, TAPS, and DIES, TURNING TOOLS, CHISELS, &c.
CAST STEEL PISTON RODS, CRANK PINS, CONNECTING RODS, STRAIGHT and CRANK AXLES, SHAFTS and FORGINGS of EVERY DESCRIPTION

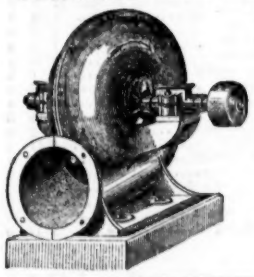
DOUBLE SHEAR STEEL	FILES MARKED
BLISTER STEEL,	T. TURTON
SPRING STEEL,	EDGE TOOLS MARKED
GERMAN STEEL,	WM. GREAVES & SON

Locomotive Engine, Railway Carriage and Wagon Springs and Buffers.

SHEAF WORKS AND SPRING WORKS, SHEFFIELD.
LONDON WAREHOUSE, 35, QUEEN STREET, CANNON STREET, CITY, E.C.
Where the largest stock of steel, files, tools, &c., may be selected from.

W. GÜNTHER,

CENTRAL ENGINEERING WORKS OLDHAM,



MANUFACTURER OF MOST IMPROVED
Silent Fans for blowing and exhausting.
" " and Steam Engines combined, for ventilation.
Direct-acting Steam Fans.
Centrifugal Pumps and Pumping Engines.
Turbine Water Wheels, for high and low falls, and variable quantities of water.
Cast-iron Smiths' Hearths.
General Engineering Work.
ILLUSTRATED PRICE LISTS AND REFERENCES ON APPLICATION.

HEPBURN'S
PUMP LEATHER
WATERPROOF

By a special method of preparation, this leather is made solid, perfectly close in texture, and impermeable to water; it has, therefore, all the qualifications essential for pump buckets, and is the most durable material of which they can be made. It may be had of all dealers in leather, and of

I. AND T. HEPBURN AND SONS,
TANNERS AND CURRIERS, LEATHER MILLBAND AND HOSE PIPE MANUFACTURERS,
LONG LANE, SOUTHWARK, LONDON.
Prize Medal 1851 1855, 1862, for
MILL BANDS, HOSE, AND LEATHER FOR MACHINERY PURPOSES.

AWARDED TWENTY GOLD AND SILVER FIRST-CLASS PRIZE MEDALS.

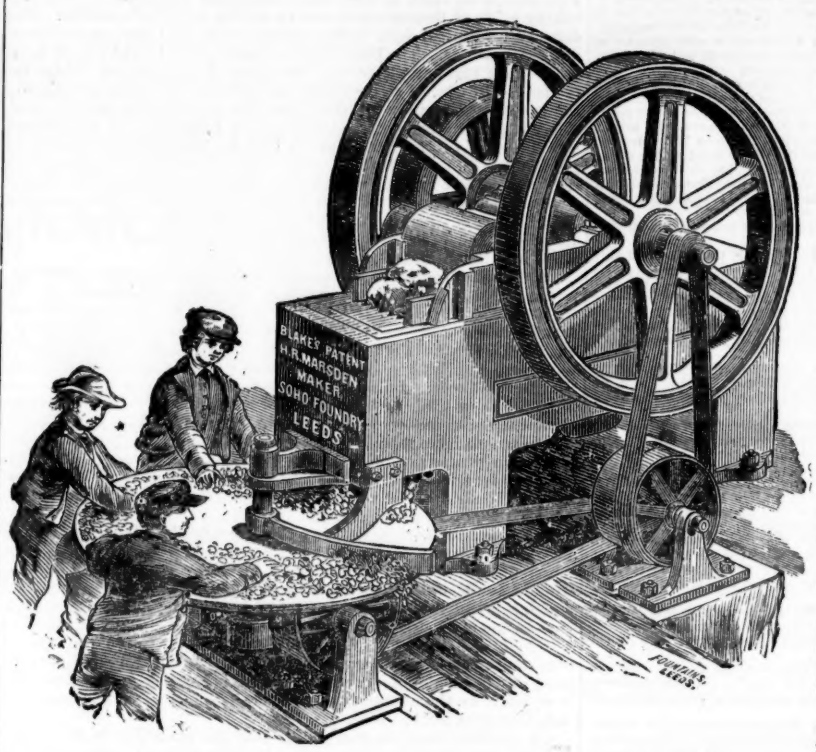
IMMENSE SAVING OF LABOUR.
TO MINERS, IRONMASTERS, MANUFACTURING CHEMISTS, RAILWAY COMPANIES. EMERY AND FLINT GRINDERS, McADAM ROAD MAKERS, &c., &c.

BLAKE'S PATENT STONE BREAKER,
OR ORE-CRUSHING MACHINE,

FOR REDUCING TO SMALL FRAGMENTS ROCKS, ORES, AND MINERALS OF EVERY KIND.

This is the only machine that has proved a success. This machine was shown in full operation at the Royal Agricultural Society's Show at Manchester, and at the Highland Agricultural Society's Show at Edinburgh, where it broke 1¼ ton of the hardest trap or winstone in eight minutes, and was AWARDED TWO FIRST-CLASS SILVER MEDALS. It has also just received SPECIAL GOLD MEDAL at Santiago, Chili.

It is rapidly making its way to all parts of the globe, being now in profitable use in California Washoe, Lake Superior, Australia, Cuba, Chili Brazil and throughout the United States and England. Read extracts of testimonials:—



The Parys Mines Company, Parys Mines, near Bangor, June 6.—We have had one of your stone breakers in use during the last 12 months, and Capt. Morcom reports most favourably as to its capabilities of crushing the materials to the required size, and its great economy in doing away with manual labour.
For the Parys Mining Company,
H. R. Marsden, Esq. JAMES WILLIAMS.

Ecton Emery Works, Manchester.—We have used Blake's patent stone breaker made by you, for the last 12 months, crushing emery, &c., and it has given every satisfaction. Some time after starting the machine a piece of the moveable jaws about 20 lbs. weight, chilled cast-iron, broke off, and was crushed in the jaws of the machine to the size fixed for crushing the emery.
THOS. GOLDSWORTHY & SONS.
H. R. Marsden, Esq.

Alkali Works, near Wednesbury.—I at first thought the outlay too much for so simple an article, but now think it money well spent.
WILLIAM HUNT.

Welsh Gold Mining Company, Dolgelly.—The stone breaker does its work admirably, crushing the hardest stones and quartz. WM. DANIEL.

Our 15 by 7 in. machine has broken 4 tons of hard whinstone in 20 minutes, for fine road metal, free from dust.
Messrs. ORD and MADDISON,
Stone and Lime Merchants, Darlington.

Kirkless Hall, near Wigan.—Each of my machines breaks from 100 to 120 tons of limestone or ore per day (10 hours), at a saving of 4d. per ton. JOHN LANCASTER.

Ovoca, Ireland.—My crusher does its work most satisfactorily. It will break 10 tons of the hardest copper ore stone per hour.
WM. G. ROBERTS.

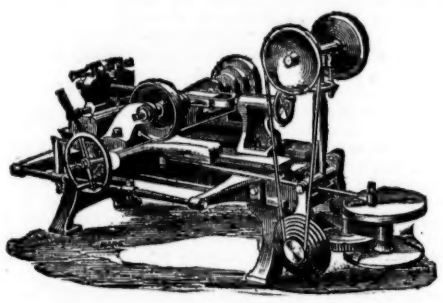
General Frémont's Mines, California.—The 15 by 7 in. machine effects a saving of the labour of about 30 men, or $75 per day. The high estimation in which we hold your invention is shown by the fact that Mr. Park has just ordered a third machine for this estate. SILAS WILLIAMS.

Your stone breaker gives us great satisfaction. We have broken 101 tons of Spanish pyrites with it in seven hours. EDWARD AARON.
H. R. Marsden, Esq. Weston, near Runcorn.

For illustrated catalogue, circulars, and testimonials, apply to—

H. R. MARSDEN, SOHO FOUNDRY,
MEADOW LANE, LEEDS,
ONLY MAKER IN THE UNITED KINGDOM.

Patent Duplex Cotter-Hole and Key-Bed DRILLING MACHINE.

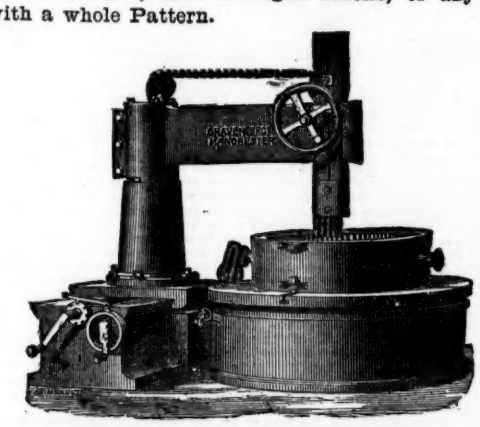


The advantage of this Machine is, that the Drills are only requisite to be half the length of the Cotter-hole required to be cut, as they operate simultaneously from both sides of the object, meeting accurately in the middle, and doing the work in less than half the usual time, besides producing a smooth hole on account of short, stiff Drills being used, thus producing a much better class of work, hitherto unattainable by the Machines with one long Drill.

The Machine is made in three sizes, and often made with double set of Head Stocks, to drill both ends of a connecting rod at the same time.

Improved WHEEL-MOULDING MACHINE.

This Machine will Mould the Teeth of Bevel, Spur, and Worm Wheels, also Straight Racks, of any Pitch with a whole Pattern.



Some of the many advantages in the use of this Machine are, that the Teeth of Wheels are perfectly straight across the Tooth, no tapes being required to draw the pattern; the Wheels are true in diameter, not depending upon a wood model, which sometimes alters in shape. Wheels of any pitch and form of teeth can be moulded without the use of a whole expensive pattern; and wheels to work into each other can be made mathematically correct in form, at the small cost of segment patterns.

The Machine is made in various sizes to mould wheels of any diameter.

CRAVEN BROTHERS,
MAKERS OF EVERY DESCRIPTION OF MACHINE TOOLS,
Vauxhall Ironworks, Osborne Street, Manchester.

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SELF-LUBRICATIVE STEAM & HYDRAULIC ENGINE PACKING.

This Packing is invaluable to all Users of Steam-Power; it supersedes anything of the kind ever invented; it is now in use in all the Chief Railways and First Firms in this Country and Abroad, and is

THE ONLY PACKING THAT WORKS WITHOUT OIL OR GREASE,

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